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Contents

Effects of Nitrogen and Potassium Fertilizers and Soil Type on Yield Components and Nutrient Uptake of Four Sugarcane Varieties

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Introduction

During the 24-year period 1952-75, tests with complete fertilizers at more than 100 locations in Louisiana showed that increases in yield from fertilizers containing nitrogen (N), phosphorous (P), and potassium (K) averaged 33 percent (*12, 20, 33*)[1]. The average during 1952-63 was 33.6 percent and the average during 1964-75 was 32.5 percent. The amounts of fertilizer N, P, and K which were compared with the check, or no-fertilizer, treatments were rates recommended to sugarcane growers during the period the tests were conducted. Since growers have normally applied fertilizer at rates recommended, it appears that the amount of the total sugarcane production in Louisiana which may be attributed to application of fertilizers is approximately 25 percent, or the amount obtained experimentally.

The most marked increases in yields are usually related to requirements by cane for N. On light- to medium-textured soils, application of K is normally economically justified (*12, 32, 33*), and on medium-heavy to heavy-textured soils, P is generally economically important and sulphur (S) may also be needed (*12, 15*).

The objective of this study was to determine the relationships of fertilizer N and K rates and soil type to yield, yield components, and nutrient uptake of selected sugarcane varieties. To achieve this objective, (a) yield and yield component data were obtained; (b) soils were analyzed for macronutrient and selected micronutrient contents and pH; (c) plant materials were analyzed for macronutrient and selected micronutrient contents; and, (d) results from statistical analyses were used as bases for conclusions reported.

Review of Literature

Borden (*5*) reported that in Hawaii the highest yields of millable cane and of sugar were generally secured from high N and K fertilization rates, whereas most relatively low yields resulted from high N and low K fertilization rates. The best juice purities and sucrose-yield-percent cane were found in low N-high K treatments.

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[1]Italic numbers in parentheses refer to Literature Cited, page 59.

Lakshmikantham (*27*) found in India that increasing the level of N fertilization led to significant depression in juice sucrose content. Application of phosphate or potash, individually or in combination, to crops grown on normal soils where large quantities of nitrogenous fertilizer had been applied did not result in a significant improvement in the sucrose content of the juice.

Samuel and Landrau (*35*) found in 112 field experiments with sugarcane in Puerto Rico that N produced an increase in sucrose content with increased yields. They reported that use of potash increased sucrose concentrations in cane only if cane yields were also increased. Potassium deficiencies produced highly significant reductions in available sugar in juice. Juice extraction percentage from cane was not significantly influenced by use of potash fertilizers.

Parish (*29*) stated that in Mauritius the plant crop responded only poorly to N, the first stubble crop fairly well, and the older stubble crops extremely well. The recommended dressings of N, therefore, increased with increasing age of stubbles.

Du Toit (*10*), in South Africa, reported that N responses were more common and relatively higher in stubbles than in plant cane. The effect of N on sucrose content of cane was small when applied as an early top dressing, but late top dressing depressed the sucrose content to a highly significant degree.

Tabayoyong (*38*) conducted a series of fertilizer and variety experiments for 7 years in the Philippines to determine the effects of soil type and fertilization on the cane and sugar yields of three cane varieties. Fertilization exerted greater effects on both cane and sugar yields than did soil type. Sugar content was not affected significantly by either soil type or fertilization. Among varieties, differences in sugar content and cane and sugar yield were significant.

Wang (*41*) reported that the NPK requirements of different cane lands in Taiwan had been elucidated. The requiremnts were closely correlated with the kinds of soils. The old, strongly leached, and acid soils were deficient in plant nutrients and needed large amounts of N, P, and K fertilizers. Potash requirements were especially strong on light soils. Tests with the minor elements, manganese (Mn), zinc (Zn), copper (Cu), and molybdenum (Mo), were conducted on several soils, but no positive responses were recorded.

Patrick et al. (*30*) studied certain physical and chemical properties of the Ap horizon of three important soil series of alluvial origin in the sugarcane area in Louisiana. The soils occurred on the natural levees of the channel now occupied by Bayou Teche in South Louisiana. They found the better drained Cypremort soils, occurring at the highest elevations and closest to the stream channel, had the coarsest texture, lowest organic matter content, and the lowest aggregation. They also contained the lowest levels of mineral nutrients. The very poorly drained and finely textured Iberia soils, occupying areas furthest from the channel at the lowest elevation, were highest in organic carbon (C), percent aggregation, and content of mineral nutrients.

Patrick et al. (*31*) made a study of soil oxygen content and root development of sugarcane in Louisiana. They found that the quantities of sugarcane roots developing below the 2-foot depth were closely related to the oxygen contents of the subsoil during the first part of the growing season. In the Baldwin and Iberia soils, oxygen content in the subsoil was often at levels considered inadequate for optimum root activity.

Baver (*4*), working in Hawaii, concluded that N fertilization had a very small effect upon the percentage increase of leaf N. Potash fertilization generally had a rather pronounced effect upon the K composition of the stalk and leaf sheath tissues.

Humbert (*24*), in Hawaii, stated that when potash levels in the plant were too low, sugar began to accumulate, an indication that the cane was growing at a reduced rate. Leaf sheath K below 2.0 percent resulted in an accumulation of unused N in the leaf. Below this level, K became a limiting factor in growth. The K level at which unused N began to accumulate was about 1.5 percent.

Suggested critical amounts of N, P, K, calcium (Ca), magnesium (Mg), and S, and range of macronutrients normally found in leaf blades of sugarcane in Louisiana are as follows (*14, 15, 17, 19*):

Macronutrient	Critical content, ppm	Normal range, ppm
N	1.25	1.06 - 2.28
P	0.14	0.12 - 0.25
K	1.00	0.48 - 1.76
Ca	0.15	0.28 - 0.47
Mg	0.08	0.14 - 0.33
S	0.13	0.07 - 0.27

Additional nutrient uptake studies in Louisiana (*12, 14, 21, 22, 34*) showed that the N content of millable cane varied from 0.97 to 2.56 pounds per ton. The P content varied from 0.21 to 0.52 and the K content from 1.89 to 4.24 pounds per ton of millable cane. The Ca, Mg, and S varied from 0.18 to 0.62, 0.28 to 0.67, and 0.40 to 0.75 pound per ton of millable cane, respectively. The N, P, and K contents of above-ground growth varied from 2.75 to 4.90, 0.46 to 0.95, and 3.28 to 6.76 pounds per ton of millable cane, respectively. The Ca, Mg, and S varied from 1.21 to 2.27, 0.78 to 1.58, and 0.72 to 1.17 pounds per ton of millable cane, respectively.

In other studies in Louisiana (*18, 21*), mean N, P, and K contents of below-ground stubble and roots varied from 0.52 to 1.83, 0.10 to 0.25, and 0.64 to 1.19 pounds per ton of millable cane, respectively. The Ca, Mg, and S (*18*) varied from 0.83 to 1.32, 0.32 to 0.50, and 0.41 to 0.52 pounds per ton of millable cane, respectively. The S contents were probably considerably higher than contents of most stubble and roots in Louisiana since the soil contained an inordinately high amount of extractable S.

There are several sugarcane producing areas where natural supplies of some micronutrients are inadequate (*6*). Copper deficiencies have been found in Florida, Natal, and Queensland, and Zn deficiencies were observed in Florida and Hawaii. Manganese deficiencies were found in Guyana, and boron (B) deficiencies were observed in Nigeria. Iron (Fe) deficiency is moderately common. Though soils are generally high in Fe, Fe availability to plants may be low due to Fe-fixation in the soils. Excessive amounts of micronutrients can lead to toxicities to sugarcane. High Mn content in acidic soils in Fiji, Puerto Rico, and Hawaii, B toxicity in Peru, and Fe toxicity in Guyana's pegasse soils resulted in negative effects on growth of sugarcane. At present, tissue analysis is the primary tool for investigating the micronutrient element status of the sugarcane crop.

Andreis (*1*) found low amounts of Fe, Mn, Zn, Cu, and B removed by millable cane in Florida and noted that most soils have received high rates of Mn, Zn, and Cu during many years of cropping to sugarcane; therefore, they generally do not need additional amounts of micronutrients except possibly when the soil pH is above 6.5.

Evans (*11*) reported critical content of micronutrients in sugarcane leaf lamina, and Juang (*25*) reported critical concentration and range without deficiency symptoms in sugarcane leaf blade as follows:

	Critical content, ppm		**Range without deficiency**
Micronutrient	**Evans**	**Juang**	**symptoms, ppm**
Fe	5	10*	20-600
Mn	20	10*	20-400
Zn	15	15	20-100
Cu	4	5	5-100
B	1	1	2- 30
Mo	.08	.05	.05- 4

*Varies with Fe/Mn ratio. Critical level can be below 10 ppm if Fe/Mn ratio is above 1.

Sedberry et al. (*36*) reported that on land-leveled soils of the Red River alluvium, Coastal Prairies, and Coastal Plain in Louisiana Zn deficiencies were found in corn, rice, and soybeans.

Karim (*26*) studied the distribution of micronutrient cations in the genetic horizons of soils in Louisiana and found that the concentration of the total micronutrient cations appeared to vary more with the clay constituents of the soils and the amounts of the elements found in the parent materials than with soil depth. The majority of the soils studied had an accumulation of total Fe, Mn, Zn, and Cu in the B horizons; however, in the clay soils, the total micronutrient cations were concentrated in the surface horizons. Total Fe was the most abundant macronutrient cation found, followed by Mn, Zn, and Cu.

Yield data from eight field tests conducted with various individual mixtures of micronutrients since 1948 by personnel of the Louisiana Agricultural Experiment Station and the U.S. Department of Agriculture showed no beneficial effect from application of the micronutrients (*8, 9, 32*). A significant decrease in cane yield was obtained from one of the tests in which Fe, Mn, Zn, and Cu were each applied at the rate of 1.2 pounds per acre. Other micronutrients included in the field tests were B and Mo.

Golden (*13*) reported that the Fe, Mn, Zn, Cu, B, and Mo contents of leaf blades generally varied from 25 to 130, 40 to 220, 12 to 40, 5 to 35, 4 to 10, and 1.6 to 3.0 ppm, respectively. Although Zn and Cu levels were apparently near or below critical levels in some areas in Louisiana, no leaf blade or yield responses to soil or foliar applications of Zn and Cu were found.

Tonimoto and Burr (*39*) found that stalk populations depended largely on total amount of N rather than timing of application. Early applications favored primary and secondary stalk growth and late applications favored tertiary stalk growth. Cane and sugar yields also depended on total amounts of N rather than timing of application.

Studying the association among yield components in sugarcane hybrid progenies in Argentina, Mariotti (*28*) found that number of stalks per plot was most closely associated with cane yield (the r-value varied between 0.771 and 0.872). Weight per stalk was next in importance. In the study on the associations between stalk erectness and yield components, he observed that large stalk diameter was apparently related to more erect clones. Weight per stalk was the character that seemed to determine more frequently the tendency to lodge.

Sornay and Davidson (*37*) stated that, of the vegetative characters of cane, stalk length is the most important for correlating with cane yield. They found no relationship between number of tillers per plot and stalk diameter or cane yield.

Henderson et al. (*23*) obtained high correlations between number of stalks of cane in unreplicated 15-foot plots and number of stalks in larger yield trials. The high correlation coefficients indicated a strong tendency for the experimental varieties, which produced high stalk populations in 15-foot plots, also to have high average stalk numbers in the yield trials.

Materials and Methods

Experimental Design, Treatments, and Soil Type

The field portion of the study was conducted during a 3-year period beginning in 1972 at an experimental site on Oaklawn Plantation, Franklin, Louisiana. Cane was planted in 1972 at the rate of two continuous stalks and a 15 percent overlap. Yield component and chemical data were obtained in 1973 from plant cane and in 1974 from first stubble cane.

The study consisted of 48 plots arranged in a randomized complete block design in which four cane varieties and four fertilizer treatments were located in three replicates. The varieties were CP52-68, L60-25, L62-96, and L65-69. Fertilizers applied to plant cane in pounds per acre of N, P_2O_5, and K_20 were 80-0-0, 80-0-80, 160-0-0, and 160-0-80. Fertilizers applied to the first stubble cane were 120-0-0, 120-0-80, 240-0-0, and 240-0-80. No fertilizer P was applied since there was a residual effect from P in filter press mud which was applied to the area approximately 20 years earlier. One replicate of treatments was located on Baldwin silt loam (Soil I), another on Baldwin silt loam-Iberia clay (Soil II), and a third on Iberia clay (Soil III). Each plot consisted of three rows that were 70 inches wide and 100 feet long.

Nitrogen, as ammonium nitrate, and K, as muriate of potash, were applied in the off-bar furrow in April of each crop year.

Determination of Cane Population

In the plant cane year, 1973, a segment of the center row of each plot 30 feet in length was staked for cane population determination and for obtaining yield data. In the first stubble cane year, 1974, the 30-foot segment of the center row was relocated within each plot to minimize a possible variation in effect of date of harvest of plant cane on first stubble cane yield.

During the period May through August of each crop year counts were made at approximately one-month intervals to determine the total plant population in each plot. September counts were estimates of the number of stalks that possibly would be of millable size. At the beginning of the first harvest, in early October of each crop year, counts were conducted to determine the number of millable stalks in each plot.

Harvesting and Determination of Certain Cane Components

Harvests were accomplished in the first week of October, the first week of November, and the last week of November of each crop year. The stalks were cut by hand at the ground line and were carried to open areas for further processing.

Cane yields were calculated from millable cane population and stalk weight data.

First Harvest — The first harvest of plant cane was conducted October

3-6, 1973. The first harvest of first stubble cane was conducted October 3-5, 1974. In each plot, a 20-stalk sample was selected at random from the millable cane on the 30-foot segment of row which was established for determination of cane population and yield data.

After removal of leaves, each cane stalk was cut at the top hard joint, which was 20-22 inches from the top visible dewlap (TVD). Stalk samples were weighed and the length and diameter of each stalk were determined. Sucrose analyses were made by Oaklawn Sugar Factory.

Second Harvest — The second harvest of the plant cane was conducted November 5-7, 1973, and the second harvest of first stubble cane was conducted November 2-3, 1974. Six-stalk samples were randomly selected from the same sites sampled at the first harvest. As a practical consideration, it was necessary that the second-harvest samples consist of a relatively small number of stalks since processing was done 100 miles away at the St. Gabriel Experiment Station, Baton Rouge. In addition to similar data collected from other harvests, samples from the second harvest were used to obtain nutrient uptake data.

At the St. Gabriel Experiment Station, the six-stalk samples consisting of all above-ground parts were weighed. After removal of leaves, each stalk was cut at the top hard joint, 16-18 inches from the TVD. Each stalk sample was weighed, and the green weight of tops and trash was obtained by difference. The length and diameter of each stalk were determined. Juice was extracted from the stalk samples and weighed. The green weight of bagasse was obtained by difference. The juice extraction percentage was obtained by dividing juice weight by sample weight.

Juice samples were analyzed for sucrose content at the St. Gabriel Experiment Station, and subsamples were frozen and maintained in a frozen state until nutrient contents were determined. Subsamples of green tops and trash and of bagasse were weighed and were dried in a forced draft oven at 70°C for 48 hours. The dry subsamples of tops and trash and of bagasse were weighed, were ground in a large Wiley mill without use of a sieve, and a portion of each subsample was further ground in a small Wiley mill to pass a 20-mesh sieve. Following sieving, the plant materials were dried 2 hours in a convection oven and were stored in glass bottles for chemical analyses. Yields of juice, tops and trash, and bagasse were calculated from cane yields and weights of plant materials obtained during processing.

Third Harvest — The third harvest of the plant cane was conducted November 29-30, 1973. The third harvest of the first stubble cane was conducted November 24-25, 1974. Stalk samples in the first and third harvests were obtained by similar methods.

After removal of leaves, each cane stalk was cut at the top hard joint, 14-16 inches from the TVD. Stalk samples were weighed and the length and diameter of each stalk were determined. Sucrose analyses were made by Oaklawn Sugar Factory.

Determination of Degree of Stalk Lodging

Lodging was rated on a scale of 0 to 10, 0 indicating no lodging at all in the field, and 10 indicating that all the stalks were lodged. The determinations were made subjectively by visual observation.

Soil and Plant Material

In the spring of 1973, soil samples were collected from each plot prior to the applications of N and K fertilizers. The topsoil samples were taken at a depth of 0-7 inches, and the subsoil samples were taken at a depth of 7-24 inches.

Leaf blade samples were taken from each plot in early July of each crop year. The leaf blades were obtained from the first leaf below the TVD. Each sample, consisting of 15 leaf blades, was dried in a forced draft oven at 70°C for 24 hours. The leaf blades were ground in a small Wiley mill to pass a 20-mesh sieve. Following sieving, the samples were dried 2 hours in a convection oven and were stored in glass bottles for chemical analyses.

Samples of juice, tops and trash, and bagasse were obtained at the second harvest each crop year and were processed for chemical analyses as previously described.

Soil and Plant Analysis Procedures

Organic C in soils was determined by the Walkley-Black (*40*) ''wet-combustion'' method, and total N in soil and plant samples was determined by the modified Kjeldahl method. ''Soil'' and extractable S were determined according to procedures described by Bardsley and Lancaster (*3*), and total S in plant samples was determined by the magnesium nitrate method (*2*). From soils, pH and the amounts of extractable P, K, Ca, and Mg were obtained using the method of Brupbacher et al. (*7*) as modified to use a Perkin-Elmer Model 303 atomic absorption spectrometer. Extractable Fe, Mn, Zn, and Cu were obtained by using the same extract (0.1 N HCl) as was used for K, Ca, and Mg. Plant materials were digested in a 4:1 mixture of concentrated nitric and perchloric acids for the determination of P, K, Ca, Mg, Fe, Mn, Zn, and Cu. With the exception of P, the amounts of these elements in plant samples were determined by use of the atomic absorption spectrometer. The amounts of P in plant samples were obtained by the chlorostannous-reduced molybdophosphoric blue color method in a hydrochloric acid system.

Statistical Analyses

Analyses of variance were obtained each crop year for the variables that were studied during the year. Simple correlation coefficients were obtained among all variables which were considered to be of possible agronomic importance.

Results and Discussion

Means of results from chemical analyses of soil samples collected from the experimental area and statistical information obtained from the data are presented in Tables 1 through 5. Information concerning shoot and/or stalk population, juice extraction, and lodging is presented only in narrative form. Tables 6 through 18 and Figure 1 show mean yield, yield component, and correlation data. Table 19 contains mean tops and trash, bagasse, and juice yields. In Tables 20 through 29, information concerning macronutrient contents of plant materials and correlations is presented. Micronutrient contents of the plant materials and related correlation coefficients are contained in Tables 30 through 35.

Generally, interactions among treatment effects on the data are discussed only when they were statistically significant.

Soil Nutrient Contents and Correlations Among Soil Nutrients and pH

Organic C, Total N, "Soil" S, Extractable S, P, K, Ca, and Mg, and Soil pH. — It can be seen in Tables 1 and 2 that the organic C and macronutrient contents of topsoil, with the exception of extractable P, were statistically higher in Soil III than in Soil I and were generally intermediate in Soil II. The subsoil extractable P, K, Ca, and Mg contents were also statistically higher in Soil III than in Soil I, but organic C and total N were statistically lower in Soil III than in Soil I. No tabular data are shown for

Table 1. — Means of organic C, total N, "Soil" S, and extractable S contents of topsoil (T) and subsoil (S) as related to soil type

Variable	Organic C		Total N		"Soil" S		Extractable S	
	T	S	T	S	T	S	T	S
	%				ppm			
Soil I	1.138	.760	.101	.065	132	86	5.2	6.7
Soil II	1.288	.695	.109	.065	152	93	8.2	8.8
Soil III	1.411	.631	.114	.059	155	82	9.8	7.7
LSD .05	.040	.102	.003	.006	11	NS	1.7	1.3

Table 2. — Means of extractable P, K, Ca, and Mg contents of topsoil (T) and subsoil (S) as related to soil type

Variable	Extractable P		Extractable K		Extractable Ca		Extractable Mg	
	T	S	T	S	T	S	T	S
	ppm							
Soil I	147	61	131	194	2808	3069	612	1251
Soil II	165	164	172	202	3818	3908	827	1295
Soil III	157	165	190	225	4299	4840	804	1545
LSD .05	NS	24	21	25	288	379	101	122

variety and fertilizer treatments since minimal bias was indicated by small and generally nonsignificant differences among means.

Simple correlation coefficients among organic C, macronutrient contents, and pH of soils are presented in Table 3. In the topsoil positive and highly significant correlations were found among organic C, total N, "Soil" S and extractable S, K, and Ca. Except for extractable P, soil pH was correlated to a highly significant degree with organic C and macronutrient contents of the topsoil. Correlation coefficients among extractable K, Ca, and Mg were highly significant. Extractable P did not correlate with any of the chemical properties of the topsoil shown in Table 3. Extractable Mg in the topsoil correlated with organic C and "Soil" S at the 5 percent level of probability. In the subsoil positive and highly significant correlations were obtained among organic C, total N, and "Soil" S. Statistically significant correlations were found among extractable K, Ca, and Mg in the subsoil.Subsoil pH was negatively related to organic C and positively related to extractable S, P, Ca, and Mg. Unlike in the topsoil, extractable P in the subsoil showed a good degree of relationship to extractable S and Ca. The correlation between "Soil" S and extractable S in the subsoil was highly significant.

Table 3. — Correlation coefficients (r)[1] among organic C contents, macronutrient contents, and pH of soils

	Total N	"Soil" S	Ext. S	Ext. P	Ext. K	Ext. Ca	Ext. Mg	pH
			Topsoil					
Organic C	.883	.681	.677	.222	.576	.780	.359	.749
Total N		.659	.563	.255	.433	.614	.284	.568
"Soil" S			.671	.083	.468	.606	.310	.702
Ext. S				.185	.430	.650	.214	.652
Ext. P					-.214	-.050	-.158	.138
Ext. K						.862	.865	.596
Ext. Ca							.671	.802
Ext. Mg								.410
			Subsoil					
Organic C	.930	.796	.043	-.231	-.148	-.030	.030	-.286
Total N		.829	.176	-.166	-.069	.004	.056	-.199
"Soil" S			.397	.059	-.096	.200	.117	.023
Ext. S				.351	-.110	.201	-.116	.350
Ext. P					-.045	.631	.236	.862
Ext. K						.503	.797	.245
Ext. Ca							.796	.831
Ext. Mg								.478

1/ Least significant r at 1% level = .369. Least significant r at 5% level = .285.

Table 4. — Means of extractable Fe, Mn, Zn, and Cu contents of topsoil (T) and subsoil (S) as related to soil type

Variable	Extractable Fe T	Extractable Fe S	Extractable Mn T	Extractable Mn S	Extractable Zn T	Extractable Zn S	Extractable Cu T	Extractable Cu S
	ppm							
Soil I	84	51	71	59	4.1	6.0	3.1	4.7
Soil II	72	104	95	94	4.6	6.7	2.7	3.6
Soil III	64	68	77	83	3.7	5.2	1.6	1.7
LSD .05	11	15	6	9	NS	NS	.9	.8

Extractable Fe, Mn, Zn, and Cu, and Soil pH. — It may be noted in Table 4 that mean extractable Fe content of the topsoil was of the general order: Soil I > Soil II > Soil III, but in the subsoil, it was highest in Soil II and lowest in Soil I. Manganese in topsoil and subsoil was of the order: Soil II > Soil III > Soil I. Differences among Soils I, II, and III in mean Zn content were not significant. Copper in topsoil and in subsoil was of the general order: Soil I > Soil II > Soil III. Practically no bias existed among variety and fertilizer treatments which may be attributed to extractable micronutrient contents of soils on which the treatments were established, hence, no tabular data are shown.

Simple correlation coefficients among organic C, micronutrient contents, and pH of soils are shown in Table 5. In the topsoil, extractable Fe was negatively correlated with organic C, and in the subsoil, it was

Table 5. — Correlation coefficients (r)[1] among organic C contents, micronutrient contents and pH of soils

	Ext. Fe	Ext. Mn	Ext. Zn	Ext. Cu	pH
		Topsoil			
Organic C	-.356	.122	-.193	-.526	.749
Ext. Fe		.038	.189	.291	-.261
Ext. Mn			.151	.019	.457
Ext. Zn				.840	.001
Ext. Cu					-.331
		Subsoil			
Organic C	-.161	-.215	.054	.060	-.286
Ext. Fe		.683	.238	.049	.344
Ext. Mn			-.016	-.376	.626
Ext. Zn				.455	-.031
Ext. Cu					-.662

1/ Least significant r at 1% level = .369. Least significant r at 5% level = .285.

positively correlated with extractable Mn. The relationship of extractable Cu to organic C in topsoil was negative, and to extractable Fe and Mn was positive. The relationship of subsoil extractable Cu to extractable Mn was negative, but to extractable Zn was positive. In the topsoil and subsoil, positive correlations were found between soil pH and extractable Mn, and negative correlations were found between soil pH and extractable Cu. A positive correlation was obtained between soil pH and organic C in the topsoil, but the relationship was negative in the subsoil. A positive correlation existed between pH and extractable Fe in the subsoil, but in the topsoil, the relationship was negative and approached significance.

Shoot and/or Stalk Population

Counts of the total number of plant and first stubble shoots and stalks per acre were made monthly from May through August. In September, counts were made to estimate the number of stalks that possibly would be of millable size. In October, the actual number of millable stalks was determined.

Plant Cane. — From May to September the numbers of shoots and/or stalks from L60-25 and L65-69 were consistently higher than the numbers from CP52-68 and L62-96. The number of millable stalks was of the order: L60-25 > L65-69 > CP52-68 > L62-96.

The numbers of millable stalks from the 80-0-0, 80-0-80, 160-0-0, and 160-0-80 treatments were 27,200, 29,070, 27,900,and 29,680 per acre, respectively.

Although shoot and stalk counts among soils in June and July were of the order: Soil II > Soil III > Soil I, the numbers of millable stalks among soil types did not differ appreciably.

First Stubble Cane. — From June to October, the order of the number of shoots and/or stalks from stubble cane was: L60-25 > L65-69 > CP52-68 > L62-96, or was of the same general order as in plant cane.

The numbers of millable stalks from the 120-0-0, 120-0-80, 240-0-0, and 240-0-80 treatments were 28,710, 31,030, 30,410, and 32,280 per acre, respectively.

Differences in number of shoots and/or stalks due to soil type were generally small throughout the growing season.

Yield as Related to Variety

Tables 6 and 7 contain mean cane and sugar yields and normal juice data as related to varieties. Significant interactions between varieties and harvest periods influenced sugar yield and sucrose content of stubble cane.

Plant Cane. — It may be noted in Table 6 that cane yield from the plant cane crop of each variety increased in approximately equal increments from Harvest 1 to Harvest 2 and from Harvest 2 to Harvest 3. Incremental increases from Harvest 1 to Harvest 2 in sugar yield were substantially

Table 6. — Effect of harvest period as an average of four fertilizer treatments and three soil types on the yield of sugarcane and sugar from four varieties of plant cane

Variety	Harvest period	Cane[1] yield	Normal juice Brix	Normal juice Sucrose[2]	Normal juice Purity	Sugar[3] yield
		T/A	%	%	%	Lb/A
CP 52-68	1	30.36	13.10	8.63	65.88	3273
	2	33.98	15.25	11.30	74.10	5213
	3	37.57	16.19	12.61	77.89	6605
Average		33.97	14.85	10.85	72.62	5030
L 60-25	1	31.60	14.90	11.36	76.24	4882
	2	35.26	17.15	14.13	82.39	7115
	3	38.00	17.76	14.78	83.22	8090
Average		34.95	16.60	13.42	80.62	6696
L 62-96	1	32.50	15.90	12.06	75.85	5408
	2	36.34	17.44	14.39	82.51	7497
	3	40.61	18.27	15.01	82.16	8808
Average		36.48	17.20	13.82	80.17	7238
L 65-69	1	33.42	16.11	11.56	70.76	5277
	2	36.98	17.71	14.42	81.42	7647
	3	40.74	18.05	14.75	81.72	8653
Average		37.05	17.29	13.58	77.97	7192

1/ For comparison of cane yield averages, LSD .05 = 1.31.
For comparison of cane yields among harvest periods, LSD .05 = 2.76.

2/ For comparison of sucrose averages, LSD .05 = .33.
For comparison of sucrose contents among harvest periods, LSD .05 = .58.

3/ For comparison of sugar yield averages, LSD .05 = 310.
For comparison of sugar yields among harvest periods, LSD .05 = 539.

larger than increases from Harvest 2 to Harvest 3. Sucrose content of normal juice of each variety at Harvest 2 was higher than at Harvest 1, and, with the exception of L65-69, the sucrose of each variety at Harvest 3 was higher than at Harvest 2.

The difference between average cane yields from CP52-68 and L60-25 was not significant. Likewise, average cane yields from L62-96 and L65-69 did not differ statistically but were statistically higher than from

CP52-68 and L60-25. The difference in average sugar yield from L62-96 and L65-69 was not significant. The average sugar yields from L62-96 and L65-69 were statistically higher than the averages from the other two varieties. The average sugar yield from L60-25 was statistically higher than the yield obtained from CP52-68.

The average sucrose content of normal juice from L62-96 was statistically higher than sucrose from L60-25 and CP52-68, but although it was

Table 7. — Effect of harvest period as an average of four fertilizer treatments and three soil types on the yield of sugarcane and sugar from four varieties of first stubble cane

Variety	Harvest period	Cane[1/] yield	Normal juice Brix	Normal juice Sucrose[2/]	Normal juice Purity	Sugar[3/] yield
		T/A	%	%	%	Lb/A
CP 52-68	1	31.99	15.23	9.59	62.97	3980
	2	37.37	17.02	12.46	73.21	6465
	3	37.16	17.30	13.72	79.31	7223
Average		35.51	16.52	11.93	71.83	5889
L 60-25	1	34.60	17.77	12.99	73.10	6313
	2	39.79	18.31	14.68	80.17	8409
	3	39.26	18.55	15.38	82.91	8745
Average		37.88	18.21	14.35	78.73	7822
L 62-96	1	30.13	18.31	12.92	70.56	5463
	2	34.65	19.16	15.25	79.59	7606
	3	34.95	19.25	16.12	83.74	8214
Average		33.24	18.91	14.76	77.96	7094
L 65-69	1	32.81	17.92	11.18	62.39	4969
	2	41.05	19.40	14.99	77.27	8867
	3	38.26	19.31	15.86	82.13	8827
Average		37.37	18.88	14.01	73.93	7555

1/ For comparison of cane yield averages, LSD .05 = 1.64.
For comparison of cane yields among harvest periods, LSD .05 = 2.83.

2/ For comparison of sucrose averages, LSD .05 = .28.
For comparison of sucrose among harvest periods, LSD .05 = .49.

3/ For comparison of sugar yield averages, LSD .05 = 336.
For comparison of sugar yields among harvest periods, LSD .05 = 581.

higher, it did not differ statistically from L65-69 normal juice sucrose. The late maturing variety, CP52-68, showed the greatest increase in sucrose between Harvests 1 and 3 (3.98 percentage points); nevertheless, sucrose at Harvest 3 for CP52-68 was substantially lower than sucrose from other varieties.

First Stubble Cane. — Significant increases in stubble cane yield (Table 7) were obtained from each variety at Harvest 2, when compared to Harvest 1, but cane yield at Harvest 3 did not differ significantly from cane yield at Harvest 2.

Sugar yield and sucrose from all varieties were significantly higher at Harvest 2 than at Harvest 1. Although sucrose from all varieties was significantly higher at Harvest 3 than at Harvest 2, only CP52-68 and L62-96 produced higher sugar yields at Harvest 3 when compared to Harvest 2. The variety x harvest period interaction which influenced sucrose content was noted primarily in relatively large sucrose increases from CP52-68 and L65-69 at Harvest 2 as compared with Harvest 1. The variety x harvest period interaction which influenced sugar yield was noted primarily in relatively large sugar yield increases from CP52-68 and L62-96 at Harvest 3 as compared with Harvest 2.

The differences in average cane and sugar yields from L60-25 and L65-69 were not significant. However, both varieties showed significantly higher average yields of cane and sugar than CP52-68 and L62-69. The cane yield average from CP52-68 was higher than the average from L62-96, but the sugar yield average was lower due to low sucrose content of CP52-68. The average sucrose content of normal juice was of the order: L62-96 > L60-25 > L65-69 > CP52-68.

Yield as Related to Fertilizer N and K

Tables 8 through 13 contain information concerning the effect of fertilizer N and K on mean cane and sugar yields and sucrose content of normal juice. Significant interactions occurred between varieties and N which affected cane and sugar yields and sucrose content of stubble cane. Other significant interactions were variety x K on sugar yield and sucrose content, and variety x N x K on sugar yield of stubble cane.

Table 8. — Effect of fertilizers as an average of four varieties and three soil types on the yield of sugarcane and sugar at three harvest periods of plant cane

Fertilizer $N-P_2O_5-K_2O$	Harvest period	Cane[1/] yield	Normal juice			Sugar[3/] yield
			Brix	Sucrose[2/]	Purity	
Lb/A		T/A	%	%	%	Lb/A
80-0-0	1	31.01	15.09	10.72	71.04	4450
	2	34.26	16.63	13.18	79.25	6359
	3	38.10	17.67	14.32	81.04	7814
Average		34.46	16.43	12.74	77.11	6208
80-0-80	1	32.56	15.06	10.96	72.78	4806
	2	36.04	17.08	13.65	79.92	6977
	3	40.18	17.62	14.34	81.38	8253
Average		36.26	16.59	12.98	78.03	6679
160-0-0	1	31.67	15.19	10.74	70.70	4557
	2	35.52	16.93	13.63	80.51	6866
	3	38.94	17.49	14.25	81.48	7940
Average		35.38	16.54	12.87	77.56	6454
160-0-80	1	32.65	15.23	11.20	73.53	4953
	2	36.72	16.87	13.78	81.68	7190
	3	39.71	17.57	14.24	81.05	8089
Average		36.36	16.56	13.07	78.76	6744

1/ For comparison of cane yield averages, LSD .05 = 1.31.
For comparison of cane yields among harvest periods, LSD .05 = 2.76.

2/ For comparison of sucrose averages, LSD .05 = .33.
For comparison of sucrose contents among harvest periods, LSD .05 = .58.

3/ For comparison of sugar yield averages, LSD .05 = 310.
For comparison of sugar yields among harvest periods, LSD .05 = 539.

Table 9. — Effect of fertilizer N as an average of two levels of fertilizer K, three soil types, and three harvest dates on the yield of sugarcane and sugar from four varieties of plant cane

Variety	Fertilizer N	Cane yield	Normal juice Brix	Normal juice Sucrose	Normal juice Purity	Sugar yield
	lb/A	T/A	%	%	%	Lb/A
CP 52-68	80	32.91	15.00	10.86	72.40	4839
	160	35.03	14.87	10.83	72.83	5169
L 60-25	80	35.13	16.46	13.22	80.32	6561
	160	34.78	16.84	13.63	80.94	6777
L 62-96	80	36.61	17.35	13.89	80.06	7319
	160	36.36	17.12	13.75	80.32	7163
L 65-69	80	36.79	17.38	13.47	77.50	7074
	160	37.31	17.44	13.68	78.44	7304
LSD .05		1.85		.48		440

Plant Cane. — It may be noted in Table 8 that the higher rate of fertilizer N did not produce significant increases in average cane yield. However, due to some interaction, the higher level of N produced a significant increase in cane yield from CP52-68 (Table 9).

Data in Table 8 indicate a significant increase in average cane yield due to fertilizer K only at the lower level of N. Increases from individual varieties due to K were not significant (Table 10), but, collectively, the response was 1.39 tons per acre and was highly significant.

Sugar yields from the two levels of N as averages of all other variables did not differ statistically.

It can be seen in Table 8 that fertilizer K at the lower level of N produced a significant increase in average sugar yield. The increase due to K at the higher level of N approached significance. Additionally, in Table 10 it can be seen that, as an average of the two levels of N and of all soil types and harvest dates, K produced statistically higher sugar yields from L60-25 and L62-96. The higher sugar yield due to K applied to L65-69 approached significance (Table 10). As an average of all other variables, the response in sugar yield due to K was 382 pounds per acre and was highly significant.

As averages of all other variables, sucrose contents of normal juice from cane fertilized with the two rates of N did not differ statistically.

As an average of all other variables, the normal juice sucrose content of cane from the K treatment was 0.22 percentage point higher than the check and approached statistical significance. The F value was 3.37. The required F value for significance at the 5 percent level of probability was 3.95.

Table 10. — Effect of fertilizer K as an average of two levels of fertilizer N, three soil types, and three harvest dates on the yield of sugarcane and sugar from four varieties of plant cane

Variety	Fertilizer K_2O	Cane yield	Normal juice Brix	Normal juice Sucrose	Normal juice Purity	Sugar yield
	Lb/A	T/A	%	%	%	Lb/A
CP 52-68	0	33.55	14.96	10.82	72.33	4953
	80	34.39	14.91	10.87	72.90	5055
L 60-25	0	34.14	16.53	13.30	80.46	6434
	80	35.76	16.76	13.54	80.79	6905
L 62-96	0	35.61	17.14	13.64	79.58	6968
	80	37.36	17.35	14.01	80.75	7514
L 65-69	0	36.38	17.40	13.47	77.41	6984
	80	37.73	17.43	13.69	78.54	7394
LSD .05		1.85		.48		440

First Stubble Cane. — Average cane yield from the 240-0-0 treatment was higher than from the 120-0-0 treatment (Table 11). Likewise, cane yield from the 240-0-80 treatment was higher than from the 120-0-80 treatment. However, a significant variety x N interaction effect on cane yield occurred (Table 12) which is shown by significant increases in yields from L62-96 and L65-69 due to the higher level of N and no significant effect of the higher level of N on cane yields from L60-25 and CP52-68.

Fertilizer K produced an increase in average cane yield at each level of N (Table 11). Although differences in responses to K among varieties were found (Table 13), the variety x K interaction effect on cane yield was not significant.

The sugar yield average from the 240-0-0 treatment (Table 11) was not significantly higher than from the 120-0-0 treatment, primarily due to a significant decrease in average sucrose content of normal juice from cane which received the higher N treatment. Sugar yield from the 240-0-80 treatment was significantly higher than from the 120-0-80 treatment.

The variety x N interaction effect on sugar yield is shown in Table 12. From L65-69, the higher N level produced higher sugar yield. The higher yield from L62-96 and the lower yield from CP52-68 at the higher N level approached significance. The small difference in sugar yield from N treatments applied to L60-25 was not significant.

Fertilizer K produced an increase in average sugar yield at each level of N (Table 11), but a variety x K interaction occurred, and the effect on sugar yield may be noted in Table 13. The sugar yield responses to K by L60-25 and L62-96 were highly significant, the response by L65-69 was significant, and the response by CP52-68 was not significant.

Table 11. — Effect of fertilizers as an average of four varieties and three soil types on the yield of sugarcane and sugar at three harvest periods of first stubble cane

Fertilizer $N-P_2O_5-K_2O$	Harvest period	Cane[1/] yield	Normal juice			Sugar[3/] yield
			Brix	Sucrose[2/]	Purity	
Lb/A		T/A	%	%	%	Lb/A
120-0-0	1	30.29	17.40	11.78	67.70	4875
	2	36.09	18.62	14.35	77.07	7371
	3	34.59	18.73	15.35	81.95	7651
Average		33.66	18.25	13.83	75.57	6632
120-0-80	1	32.89	17.20	11.85	68.90	5352
	2	37.77	18.49	14.53	78.58	7833
	3	38.66	18.71	15.35	82.04	8570
Average		36.44	18.13	13.91	76.51	7252
240-0-0	1	31.32	17.18	11.26	65.54	4810
	2	38.19	18.33	14.12	77.03	7733
	3	36.75	18.50	15.22	82.27	8097
Average		35.42	18.00	13.53	74.95	6880
240-0-80	1	35.02	17.42	11.80	67.74	5689
	2	40.81	18.53	14.38	77.60	8409
	3	39.62	18.56	15.17	81.73	8692
Average		39.48	18.17	13.78	75.69	7597

1/ For comparison of cane yield averages, LSD .05 = 1.64.
For comparison of cane yields among harvest periods, LSD .05 = 2.83.

2/ For comparison of sucrose averages, LSD .05 = .28.
For comparison of sucrose contents among harvest periods, LSD .05 = .49.

3/ For comparison of sugar yield averages, LSD .05 = 336.
For comparison of Sugar yields among harvest periods, LSD .05 = 581.

Sugar yield data showing the variety x N x K interaction are contained in Tables 12 and 13. The positive effect of the higher N level on sugar yield from varieties was of the order: L65-69 > L62-96 > L60-25 > L52-68 (Table 12), whereas the positive effect of fertilizer K on sugar yield was of the order: L60-25 > L62-96 > L65-69 > CP52-68 (Table 13).

Table 12. — Effect of fertilizer N as an average of two levels of fertilizer K, three soil types, and three harvest dates on the yield of sugarcane and sugar from four varieties of first stubble cane

Variety	Fertilizer N	Cane yield	Normal juice Brix	Normal juice Sucrose	Normal juice Purity	Sugar yield
	lb/A	T/A	%	%	%	Lb/A
CP 52-68	120	36.19	16.72	12.12	72.49	6119
	240	34.82	16.61	11.73	70.62	5659
L 60-25	120	37.25	18.07	14.44	79.91	7759
	240	38.52	18.14	14.26	78.61	7886
L62-96	120	31.50	19.22	15.03	78.20	6866
	240	34.98	18.66	14.50	77.71	7323
L65-69	120	35.26	18.87	13.87	73.50	7024
	240	39.49	19.04	14.15	74.32	8085
LSD .05		2.31		.40		475

Table 13. — Effect of fertilizer K an an average of two levels of fertilizer N, three soil types, and three harvest dates on the yield of sugarcane and sugar from four varieties of first stubble cane.

Variety	Fertilizer K_2O	Cane yield	Normal juice Brix	Normal juice Sucrose	Normal juice Purity	Sugar yield
	Lb/A	T/A	%	%	%	Lb/A
CP 52-68	0	34.27	16.93	12.16	71.83	5824
	80	36.74	16.40	11.69	71.28	5954
L 60-25	0	35.40	18.02	14.22	78.91	7222
	80	40.37	18.18	14.48	79.65	8423
L 62-96	0	31.90	18.87	14.48	76.74	6669
	80	34.58	19.00	15.05	79.21	7520
L65-69	0	36.58	18.83	13.86	73.61	7310
	80	38.16	19.09	14.17	74.23	7799
LSD .05		2.31		.40		475

The variety x N interaction effect on sucrose content of normal juice may be noted in Table 12. Sucrose from L62-96 decreased significantly due to the higher level of N. The decrease from CP52-68 and the increase from L65-69 approached significance. Sucrose difference due to the two levels of N applied to L60-25 was not significant.

The variety x K interaction on sucrose can be seen in Table 13. Sucrose from L62-96 increased significantly and sucrose from CP52-68 decreased significantly due to K. Although positive, the effects of K on sucrose from L60-25 and L65-69 were not significant.

Fertilizer K and Early-Maturing Varieties. — A summary of the positive effect of fertilizer K on mean sucrose from the early-maturing varieties, L60-25, L62-96, and L65-69, is shown in Figure 1. The effect was generally constant in plant and stubble cane until about mid-November.

On light- to medium-textured soils, in addition to increases in cane yield, there is a substantial tendency for cane, particularly stubble cane, of early-maturing or high-sucrose varieties to contain higher amounts of sucrose due to fertilizer K. This was shown in eight additional field tests on Commerce silt loam in Louisiana during 1972-75 (*12*). Varieties tested were CP61-37, CP48-103, L62-96, L65-69, and CP65-357. In early October the average increase in sucrose content of normal juice from seven tests with stubble cane was 0.57 percentage point and in early November the average increase was 0.28 percentage point. Each increase was highly significant.

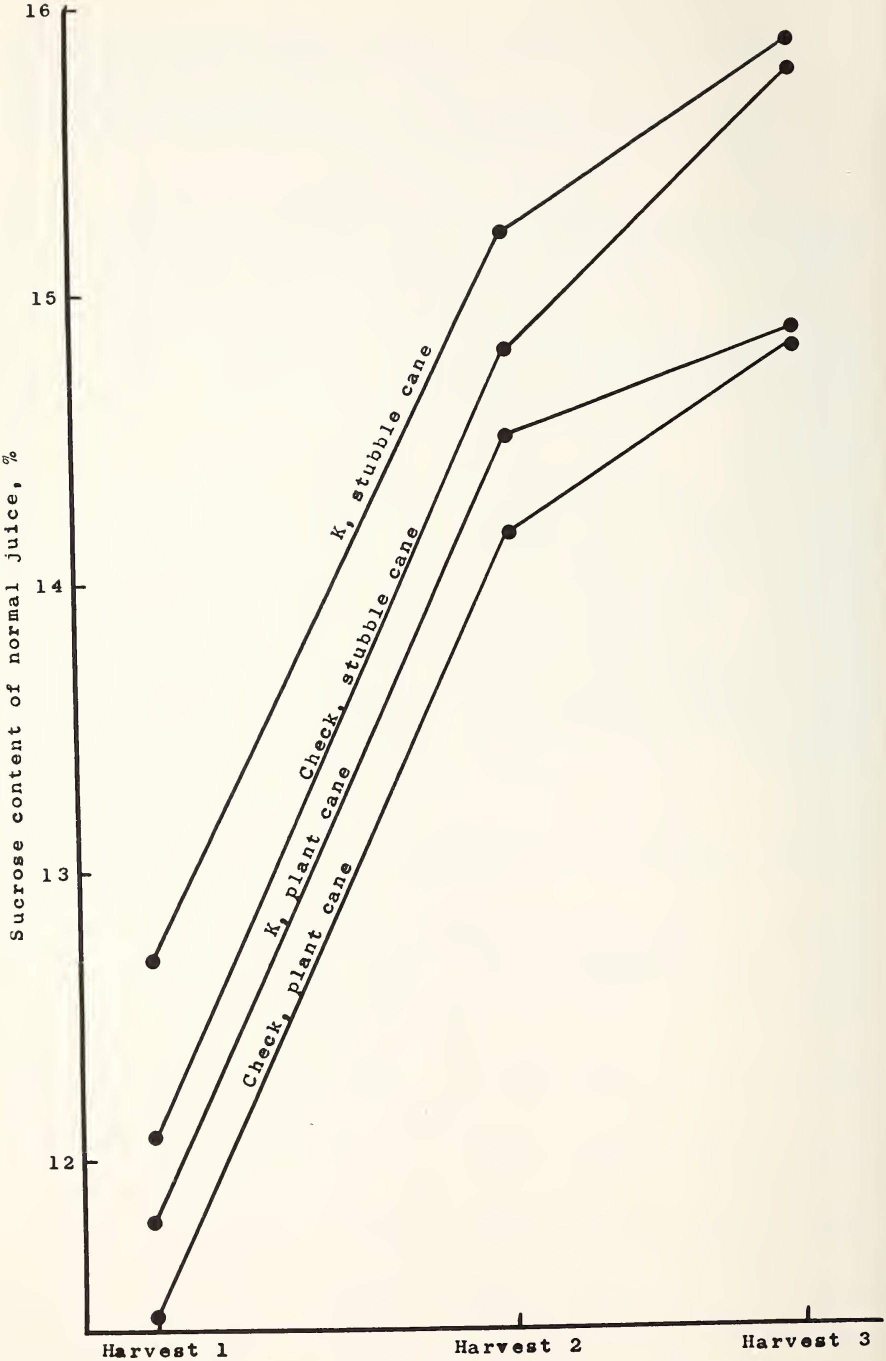

Figure 1. — The effect of fertilizer K on sucrose content of normal juice from the early maturing varieties, L60-25, L62-96, and L65-69

Yield and Sucrose as Related to Soil Type

Tables 14 and 15 show mean cane and sugar yields and normal juice data as related to soil type.

Plant Cane. — It may be noted in Table 14 that cane yield averages were higher from Soils I and II than from Soil III.

Although sugar yield averages were of the order: Soil III > Soil II > Soil I, only the difference between averages from Soils I and III was statistically significant.

Sucrose content of normal juice from cane on Soil III was higher than from cane on Soils I and II.

Table 14. — Effect of soil type as an average of four varieties and four fertilizer treatments on the yield of sugarcane and sugar at three harvest periods of plant cane

Soil	Harvest period	Cane[1/] yield	Normal juice			Sugar[3/] yield
			Brix	Sucrose[2/]	Purity	
		T/A	%	%	%	Lb/A
Baldwin sil	1	32.04	14.24	10.41	73.10	4428
(Soil I)	2	35.89	16.52	13.22	80.02	6686
	3	40.05	17.25	14.04	81.39	8022
Average		35.99	16.00	12.56	78.17	6379
Baldwin sil-						
Iberia c	1	32.73	15.05	10.64	70.70	4651
(Soil II)	2	35.41	16.76	13.41	80.01	6710
	3	40.02	17.57	14.26	81.16	8164
Average		36.05	16.46	12.77	77.29	6508
Iberia c	1	31.14	16.02	11.65	72.72	4964
(Soil III)	2	35.68	17.44	14.01	80.33	7129
	3	37.62	17.95	14.57	81.17	7874
Average		34.81	17.14	13.41	78.08	6656

1/ For comparison of cane yield averages, LSD .05 = 1.13.
For comparison of cane yields among harvest periods, LSD .05 = 1.96.

2/ For comparison of sucrose averages, LSD .05 = .29.
For comparison of sucrose contents among harvest periods, LSD .05 = .50.

3/ For comparison of sugar yield averages, LSD .05 = 269.
For comparison of sugar yields among harvest periods, LSD .05 = 466.

First Stubble Cane. — Data in Table 15 show cane yield averages from the first stubble crop were of the order: Soil I > Soil II > Soil III. The difference between averages from Soils I and II approached significance, and the difference between Soils I and III was significant.

The sugar yield average from Soil II was significantly higher than from Soil I. The differences in averages from Soils II and III and from Soils I and III were not significant.

Average sucrose contents of normal juice from Soils II and III were approximately equal and were significantly higher than from Soil I.

Sucrose and Soil Type. — Since sucrose from cane on Soil III (Iberia clay) was higher than sucrose from cane on Soil I (Baldwin silt loam) in 1973 and 1974, samples from the plots were taken from second stubble

Table 15. — Effect of soil type as an average of four varieties and four fertilizer treatments on the yield of sugarcane and sugar at three harvest periods of first stubble cane

Soil	Harvest period	Cane[1/] yield	Normal juice Brix	Normal juice Sucrose[2/]	Normal juice Purity	Sugar[3/] yield
		T/A	%	%	%	Lb/A
Baldwin sil (Soil I)	1	32.66	17.26	10.83	62.75	4755
	2	39.40	17.90	13.58	75.87	7581
	3	39.67	18.16	14.89	81.99	8513
Average		37.24	17.77	13.10	73.54	6950
Baldwin sil-Iberia c (Soil II)	1	32.26	17.19	12.10	70.39	5394
	2	38.58	18.73	14.63	78.11	8110
	3	36.69	18.86	15.53	82.34	8274
Average		35.84	18.26	14.09	76.95	7259
Iberia c (Soil III)	1	32.23	17.43	12.08	69.31	5379
	2	36.66	18.84	14.83	78.72	7831
	3	35.85	18.85	15.40	81.70	8005
Average		34.91	18.37	14.10	76.58	7072

1/ For comparison of cane yield averages, LSD .05 = 1.42.
For comparison of cane yields among harvest periods, LSD .05 = 2.45.

2/ For comparison of sucrose averages, LSD .05 = .24.
For comparison of sucrose contents among harvest periods, LSD .05 = .42.

3/ For comparison of sugar yield averages, LSD .05 = 291.
For comparison of sugar yields among harvest periods, LSD .05 = 504.

cane in 1975 with the result that the trend was reversed, or sucrose from Soil III was lower than from Soil I. These observations, together with mixed results from additional similar work on soils near the Mississippi River in 1975, justify the conclusion that no general trend appears to exist concerning sucrose content of cane grown on light- as opposed to heavy-textured soils in Louisiana.

Stalk Weight, Length, and Diameter

Except at Harvest 2 of first stubble cane, mean stalk weights of plant and stubble cane at all harvests (Tables 16 and 17) were of the order: L62-96 > L65-69 = CP52-68 > L60-25. The deviation from the normal order of stalk weights among varieties at Harvest 2 of first stubble cane probably was due to the low number of stalks obtained per sample (six) as compared to the larger number obtained per sample (20) at other harvests.

Stalk weights among soil types at Harvest 3 of plant and stubble cane were of the order: Soil I > Soil II > Soil III. The weights from Soils I and III differed statistically in stubble cane and approached significance in plant cane. Other relationships of weights from plant and stubble cane to fertilizer treatments and soil types were either not significant or were not considered important.

Mean stalk length of plant and stubble cane at all harvests was generally of the order: L65-69 = CP52-68 > L62-96 > L60-25, but most of the

Table 16. — Mean stalk weight, length and diameter of plant cane at three harvest periods as related to variety, fertilizer treatment and soil type

Variable	Harvest Period								
	1			2			3		
	Wt	Length	Diam.	Wt	Length	Diam.	Wt	Length	Diam.
	Lb	In.	In.	Lb	In.	In.	Lb	In.	In.
CP 52-68	2.18	77.5	.95	2.44	95.1	.92	2.69	97.6	.95
L 60-25	2.03	73.5	1.01	2.27	85.7	1.00	2.44	88.2	.99
L 62-96	2.60	76.2	1.09	2.85	87.0	1.02	3.20	93.7	1.06
L 65-69	2.21	80.8	.98	2.44	94.6	.96	2.69	98.6	.97
LSD .05	.14	3.6	.05	.15	4.1	.03	.16	4.0	.03
80-0-0	2.28	78.2	1.00	2.53	93.9	.99	2.81	97.1	1.00
80-0-80	2.24	76.3	1.01	2.47	90.6	.97	2.76	94.6	.99
160-0-0	2.27	78.5	1.01	2.53	90.9	.97	2.78	94.4	.99
160-0-80	2.20	75.1	1.00	2.47	87.0	.98	2.66	92.0	.98
LSD .05	NS	NS	NS	NS	4.1	NS	NS	4.0	NS
Soil I	2.25	80.0	1.01	2.51	91.7	.97	2.81	96.9	.99
Soil II	2.28	76.7	1.01	2.47	90.2	.97	2.78	95.9	.99
Soil III	2.21	74.3	1.00	2.53	89.9	.99	2.67	90.8	.99
LSD .05	NS	3.2	NS	NS	NS	NS	NS	3.5	NS

differences between L62-96 and L60-25 were not significant.

There was a trend for fertilizer K to decrease stalk length of plant cane (Table 16), and, as an average of the two levels of fertilizer N and the other variables, the effect was significant at Harvests 1 and 2. The trend did not exist in stubble cane (Table 17). There was also a trend in plant and stubble cane for stalk length to vary among soil types in the order: Soil I > Soil II > Soil III.

Generally, stalk diameter was highest from L62-96 and lowest from CP52-68, but the differences were relatively small in stubble cane. Relationships of diameter to fertilizer treatment and soil type in plant and stubble cane were generally small and not significant.

Correlations Among Yield and Stalk Data

Simple correlation coefficients among number of stalks of millable cane, cane yield, and stalk weight, length, and diameter at three harvest periods are presented in Table 18.

In plant cane, the number of millable stalks was significantly correlated with Yield 2, while in stubble cane, it was correlated with cane yield at each harvest. Number of stalks was negatively correlated with stalk weight in plant and stubble cane at all harvests. Number of stalks was negatively correlated with stalk diameter only at Harvests 1 and 3 of plant cane.

Except for the low correlation between Yield 2 and Length 2 in plant

Table 17. — Mean stalk weight, length, and diameter of first stubble at three harvest periods as related to variety, fertilizer treatment, and soil type

	Harvest Period								
	1			2			3		
Variable	Wt	Length	Diam.	Wt	Length	Diam.	Wt.	Length	Diam.
	Lb	In.	In.	Lb	In.	In.	Lb	In.	In.
CP 52-68	2.13	76.3	.94	2.50	83.1	.99	2.48	82.5	.95
L 60-25	1.94	70.9	.98	2.23	77.6	.98	2.20	76.6	.96
L 62-96	2.24	72.0	.99	2.58	78.5	1.01	2.61	78.5	1.00
L 65-69	2.14	76.7	.95	2.68	86.2	.99	2.49	83.7	.95
LSD .05	.10	2.4	.03	.18	2.9	NS	.13	2.5	.03
120-0-0	2.11	74.5	.95	2.52	81.4	1.00	2.41	80.2	.96
120-0-80	2.12	73.8	.97	2.43	80.8	.98	2.49	80.9	.96
240-0-0	2.06	73.5	.95	2.52	81.6	.99	2.42	79.8	.98
240-0-80	2.17	74.0	.98	2.53	81.6	1.00	2.46	80.4	.97
LSD .05	.10	NS	.03	NS	NS	NS	NS	NS	NS
Soil I	2.12	74.7	.94	2.55	84.0	.98	2.57	84.4	.96
Soil II	2.11	73.9	.95	2.54	81.8	1.00	2.41	80.0	.96
Soil III	2.12	73.2	.99	2.41	78.3	1.00	2.36	76.6	.98
LSD .05	NS	NS	.03	NS	2.5	NS	.11	2.1	NS

Table 18. — Correlation coefficients (r)[1] among the number of stalks of millable cane, cane yield, and stalk weight, length and diameter at three harvest periods[2]

	Yield 1	Yield 2	Yield 3	Wt 1	Wt 2	Wt 3	Length 1	Length 2	Length 3	Diam. 1	Diam. 2	Diam. 3
						Plant Cane						
No. of stalks	.282	.312	.223	-.726	-.661	-.688	-.228	-.199	-.198	-.494	-.066	-.419
Yield 1		.401	.639	.445	.076	.234	.342	-.127	.188	.319	.197	.134
Yield 2			.545	.004	.499	.136	-.188	.028	.095	.030	.529	.166
Yield 3				.251	.238	.545	.099	-.069	.443	.174	.256	.401
Wt 1					.681	.816	.444	.075	.299	.714	.227	.532
Wt 2						.748	.054	.172	.240	.502	.506	.547
Wt 3							.246	.085	.470	.582	.284	.702
Length 1								.445	.555	.019	-.352	-.135
Length 2									.669	-.377	-.378	-.310
Length 3										-.180	-.295	.024
Diam. 1											.485	.633
Diam. 2												.634
						First Stubble Cane						
No. of stalks	.780	.616	.713	-.427	-.409	-.427	-.127	.015	-.043	.128	-.207	-.202
Yield 1		.679	.818	.228	-.101	.008	.209	.240	.175	.397	-.073	-.017
Yield 2			.734	.007	.462	.101	.350	.598	.439	.046	.289	-.081
Yield 3				.082	.042	.326	.263	.402	.482	.093	-.103	.042
Wt 1					.479	.693	.479	.301	.307	.401	.216	.319
Wt 2						.592	.533	.676	.545	-.083	.568	.157
Wt 3							.490	.477	.656	-.017	.148	.362
Length 1								.736	.772	-.213	-.045	-.236
Length 2									.792	-.324	-.018	-.186
Length 3										-.456	-.116	-.247
Diam. 1											.328	.460
Diam. 2												.400

1/ Least significant r at 1% level = .369. Least significant r at 5% level = .285.

2/ The number of stalks was determined only at the first harvest and the other variables were determined at each of the three harvest periods. The designations, 1, 2 and 3 refer to yield and yield-component data obtained at Harvests 1, 2 and 3.

cane, which probably resulted from the relatively low number of stalks obtained per sample at Harvest 2, plant cane yields correlated significantly with all corresponding stalk weights, lengths, and diameters. A similar trend was noted in stubble cane. The exceptions in stubble cane were low correlations between Yield 1 and Weight 1, Yield 1 and Length 1, and Yield 3 and Diameter 3.

Except for the low correlation between Weight 2 and Length 2 in plant cane, plant and stubble cane weights correlated significantly with all corresponding stalk lengths and diameters.

Stalk length and diameter were negatively correlated at Harvest 2 of plant cane and negative correlations at Harvests 1 and 3 of stubble cane approached significance.

Juice Extraction and Lodging Rating

It was found that the percentage juice extraction from plant and stubble cane was not significantly related to variety, fertilizer treatment, or soil type.

Lodging ratings showed that most of the CP52-68 plant cane did not lodge and that only a relatively small amount of CP52-68 stubble cane lodged. Plant and stubble cane of other varieties lodged to a substantial degree. Degree of lodging was not significantly associated with fertilizer treatment or soil type in plant and stubble cane. The generally higher degree of stubble cane lodging was due partially to Hurricane Carmen, September 6-7, 1974.

Tops and Trash, Bagasse, and Juice Yields

Table 19 contains data showing mean yields of tops and trash, bagasse, and juice from plant and stubble cane as related to variety, fertilizer treatment, and soil type. Calculations with these data and macronutrient data in Tables 21 through 26 were made to determine macronutrient contents of above-ground parts of cane which are reported in Tables 21 through 26. Similar calculations with data in Table 19 and micronutrient data in Tables 31 through 34 were made to determine the micronutrient contents of above-ground parts of cane which are reported in Tables 31 through 34.

Differences among yields of cane components shown in Table 19 influenced nutrient content data, but the differences are considered less important, for purposes of this study, than differences among nutrient contents of cane, which are discussed later in detail.

Table 19. — Mean tops and trash[1], bagasse[1], and juice[2] yields of plant and first stubble cane as related to variety, fertilizer treatment, and soil type

	Plant Cane			First stubble Cane		
Variable	Tops&trash	Bagasse	Juice	Tops&trash	Bagasse	Juice
	-Lb/A-					
CP 52-68	5350	10639	39693	6510	13429	39381
L 60-25	5191	11145	41401	5770	14727	42055
L 62-96	5934	12232	41360	6525	13396	36141
L 65-69	6117	12498	43885	7696	15662	43737
LSD .05	440	1048	NS	513	1175	3558
N1-0-0[3]	5571	11151	40469	6395	13608	38198
N1-0-80	5427	11844	41912	6575	14304	39629
N2-0-0	5534	11656	41295	6583	14412	39916
N2-0-80	6061	11864	42662	6949	14891	43573
LSD .05	440	NS	NS	513	1175	3558
Soil I	6032	11628	42146	6737	14884	41647
Soil II	5358	11421	41549	6559	14445	40689
Soil III	5555	11837	41059	6580	13582	38651
LSD .05	382	NS	NS	NS	1018	NS

1/ Dry matter basis.
2/ Wet basis.
3/ N1 = 80 lb of N/A for plant and 120 lb/A for first stubble cane.
N2 = 160 lb of N/A for plant and 240 lb/A for first stubble cane.

Macronutrient Contents of Leaf Blades

The N content of leaf blades from CP52-68 plant and stubble cane (Table 20) was significantly lower than the N content of the other varieties. In stubble cane the N content of L62-96 was significantly higher than the N content of L60-25 and L65-69. The N content of plant cane leaf blades from the 160-0-0 treatment was significantly higher than from the 80-0-0 treat-

Table 20. — Mean macronutrient content of leaf blades as related to variety, fertilizer treatment, and soil type

Variable	Macronutrient content					
	N	S	P	K	Ca	Mg
	%					
			Plant Cane			
CP 52-68	1.53	.146	.157	1.43	.290	.144
L 60-25	1.63	.146	.157	1.50	.256	.179
L 62-96	1.60	.150	.199	1.61	.300	.136
L 65-69	1.60	.140	.191	1.61	.280	.155
LSD .05	.04	NS	.005	.09	.012	.009
80-0-0	1.57	.145	.178	1.45	.287	.158
80-0-80	1.58	.147	.176	1.58	.280	.151
160-0-0	1.61	.151	.174	1.51	.276	.153
160-0-80	1.60	.138	.176	1.61	.283	.153
LSD .05	.04	NS	NS	.09	NS	NS
Soil I	1.59	.159	.178	1.54	.292	.164
Soil II	1.57	.135	.172	1.44	.280	.156
Soil III	1.59	.142	.178	1.64	.273	.141
LSD .05	NS	.013	.005	.08	.011	.008
			First Stubble Cane			
CP 52-68	1.47	.119	.175	1.08	.334	.168
L 60-25	1.62	.124	.175	1.22	.261	.198
L 62-96	1.69	.131	.219	1.36	.329	.157
L 65-69	1.60	.113	.218	1.27	.269	.167
LSD .05	.05	.013	.010	.11	.018	.010
120-0-0	1.59	.122	.204	1.11	.301	.178
120-0-80	1.59	.124	.198	1.33	.287	.163
240-0-0	1.59	.122	.194	1.13	.312	.181
240-0-80	1.62	.120	.192	1.35	.292	.168
LSD .05	NS	NS	.010	.11	.018	.010
Soil I	1.64	.136	.204	1.22	.302	.181
Soil II	1.57	.117	.196	1.23	.302	.173
Soil III	1.58	.112	.190	1.24	.290	.164
LSD .05	.04	.011	.008	NS	NS	.009

ment. Differences in N content of leaf blades among fertilizer treatments of stubble cane were not significant. The N content of stubble cane leaf blades from Soil I was higher than from Soils II and III.

Leaf S was not significantly related to varieties in plant cane, nor was it related to fertilizer treatments in plant and stubble cane. In stubble cane, leaf S was significantly higher in L62-96 than in L65-69. In plant and stubble cane, leaf S was statistically of the order: Soil I> Soil II = Soil III.

The leaf-blade P contents from CP52-68 and L60-25 plant and stubble cane were substantially lower than from L62-96 and L65-69. Leaf-blade P contents were not influenced by fertilizer treatments in plant cane. The influence of fertilizers on P in stubble cane was not considered important due to the relatively high contents, compared with plant cane, and generally high levels of leaf-blade P in both plant and stubble cane (*14, 19*). Leaf-blade P content from plant cane on Soil II was significantly lower than from cane on Soils I and III. In stubble cane, leaf P was of the order: Soil I > Soil II > Soil III, and the differences between Soils I and II, and between Soils I and III were significant.

Leaf K contents from CP52-68 and L60-25 plant cane were significantly lower than from L62-96 and L65-69. In stubble cane, leaf K was of the order: L62-96 > L65-69 > L60-25 > CP52-68, but the differences between L62-96 and L65-69, and between L65-69 and L60-25, were not significant.

Fertilizer N, as an average of all other variables, resulted in no significant effect on leaf K of plant and stubble cane. Fertilizer K, as an average of all other variables, resulted in increases of K in plant and stubble cane leaf blades at both levels of N. In plant cane, leaf K was of the order: Soil III> Soil I> Soil II, and in stubble cane, differences in leaf K among soil types were not significant.

Since Ca and Mg contents of leaf blades were substantially higher than levels considered to be critically low for nutrition of sugarcane in Louisiana (*17*), differences noted among variables were apparently of little consequence.

Macronutrient Contents of Above-Ground Parts

Calculations with data showing macronutrient contents of tops and trash, bagasse, and juice from Tables 21 through 26 and appropriate yields in Table 19 resulted in values shown in Tables 21 through 26. Values for macronutrient contents of millable cane are in pounds per acre and pounds per ton, and values for macronutrient contents of above-ground parts are in pounds per acre and pounds per ton of millable cane.

Nitrogen. — In plant cane (Table 21), L60-25 contained significantly more N in each ton of millable cane than CP52-68 and L62-96, but differences among varieties in stubble cane were not significant. The N contents of millable cane and of above-ground parts differed significantly among varieties in pounds per acre, partially due to differences in yield, but the N contents of above-ground parts were not significantly different among varieties in pounds per ton of millable cane.

For N contents of plant parts, the effect of the higher rate of fertilizer N,

Table 21. — Mean nitrogen contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Tops&tr.	Bagasse	Juice	Millable cane(MC)		Above-ground parts	
	Nitrogen Content						
	- - - - - %	- - - - -	- -	Lb/A	Lb/T	Lb/A	Lb/T MC
			Plant Cane				
CP 52-68	.88	.34	.070	63.2	1.87	111.4	3.27
L 60-25	.86	.37	.073	71.9	2.04	116.3	3.30
L 62-96	.90	.31	.067	65.5	1.80	118.7	3.27
L 65-69	.85	.34	.070	72.6	1.96	124.7	3.37
LSD .05	NS	.03	NS	6.4	.14	8.3	NS
80-0-0	.86	.32	.062	60.5	1.77	108.3	3.17
80-0-80	.86	.32	.063	64.0	1.78	111.4	3.10
160-0-0	.90	.35	.076	72.0	2.03	122.0	3.43
160-0-80	.87	.36	.080	76.7	2.08	129.3	3.52
LSD .05	NS	.03	.008	6.4	.14	8.3	.16
Soil I	.91	.35	.066	67.9	1.90	122.8	3.43
Soil II	.87	.34	.066	66.3	1.87	114.0	3.22
Soil III	.82	.33	.078	70.7	1.98	116.5	3.26
LSD .05	.05	NS	.007	NS	NS	7.2	.14
		First Stubble Cane					
CP 52-68	.70	.36	.065	74.6	1.99	120.2	3.23
L 60-25	.77	.38	.063	83.2	2.10	127.6	3.21
L 62-96	.76	.34	.065	69.2	1.98	119.0	3.41
L 65-69	.74	.35	.058	82.0	1.98	138.9	3.36
LSD .05	.06	.03	NS	8.6	NS	10.4	NS
120-0-0	.71	.34	.053	67.6	1.86	112.6	3.12
120-0-80	.71	.31	.053	66.0	1.74	112.7	2.98
240-0-0	.78	.39	.074	86.6	2.27	138.1	3.64
240-0-80	.77	.39	.071	88.8	2.17	142.3	3.47
LSD .05	NS	.03	.009	8.6	.18	10.4	.22
Soil I	.81	.39	.070	88.0	2.23	143.0	3.63
Soil II	.74	.35	.060	75.6	1.95	123.9	3.21
Soil III	.67	.33	.059	68.2	1.85	112.5	3.07
LSD .05	.05	.03	.008	7.5	.16	9.0	.19

160 pounds per acre in plant cane, when compared with the 80-pounds-per-acre rate, and 240 pounds per acre in stubble cane, when compared with the 120-pound-per-acre rate, with or without fertilizer K, was positive and generally statistically significant.

As an average of fertilizer N treatments and all other variables, fertilizer K applied to stubble cane resulted in some decrease in the N content of above-ground parts in pounds per ton of millable cane. The F-value was 4.07 and the required F-value for significance at the 5 percent level of probability was 4.17.

Table 22. — Mean sulphur contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Sulphur content						
	Tops&tr.	Bagasse	Juice	Millable cane(MC)		Above-ground parts	
	- - - - - % - - - - - - -			Lb/A	Lb/T	Lb/A	Lb/T MC
			Plant Cane				
CP 52-68	.117	.051	.0145	11.28	.33	17.55	.52
L 60-25	.098	.048	.0148	11.29	.32	16.56	.47
L 62-96	.111	.035	.0118	9.09	.25	15.64	.43
L 65-69	.092	.041	.0127	16.27	.29	16.33	.44
LSD .05	.013	.007	NS	1.92	.05	NS	NS
80-0-0	.114	.046	.0128	10.28	.30	16.61	.49
80-0-80	.096	.042	.0137	10.81	.30	15.89	.44
160-0-0	.114	.046	.0137	11.01	.31	17.27	.49
160-0-80	.093	.042	.0136	10.65	.29	16.29	.44
LSD .05	.013	NS	NS	NS	NS	NS	NS
Soil I	.108	.050	.0149	12.20	.34	18.48	.52
Soil II	.107	.042	.0132	10.27	.29	15.95	.45
Soil III	.099	.039	.0123	9.63	.27	15.12	.43
LSD .05	NS	.006	NS	1.76	.05	2.12	.06
			First Stubble Cane				
CP 52-68	.085	.037	.0043	6.70	.18	12.20	.33
L 60-25	.085	.032	.0046	6.73	.17	11.52	.29
L 62-96	.088	.031	.0039	5.63	.16	11.32	.33
L 65-69	.074	.030	.0037	6.29	.15	11.92	.29
LSD .05	NS	NS	.0008	NS	NS	NS	NS
120-0-0	.085	.031	.0043	5.86	.16	11.32	.31
120-0-80	.083	.036	.0048	7.11	.19	12.55	.33
240-0-0	.087	.034	.0038	6.49	.17	11.96	.32
240-0-80	.077	.029	.0036	5.85	.14	11.13	.27
LSD .05	NS	NS	.0008	NS	NS	NS	NS
Soil I	.089	.033	.0049	6.97	.18	12.83	.33
Soil II	.079	.031	.0035	5.91	.15	10.96	.29
Soil III	.082	.034	.0040	6.16	.17	11.42	.32
LSD .05	NS	NS	.0007	NS	NS	1.16	NS

In plant and stubble cane, the N content of above-ground parts in pounds per ton of millable cane was statistically of the order: Soil I> Soil II = Soil III.

Sulphur. — No general relationship was noted in plant and stubble cane among S contents of plant parts and varieties or fertilizer treatments (Table 22).

In plant cane, there was a tendency for S contents to vary in the order: Soil I> Soil II> Soil III, but in stubble cane a similar tendency did not exist.

Table 23. — Mean phosphorus contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Phosphorus content						
	Tops&tr.	Bagasse	Juice	Millable cane(MC)		Above-ground parts	
	- - - - - % - - - - - - -			Lb/A	Lb/T	Lb/A	Lb/T MC
			Plant Cane				
CP 52-68	.105	.060	.0145	12.17	.36	17.81	.52
L 60-25	.099	.056	.0126	11.47	.33	16.62	.47
L 62-96	.123	.060	.0150	13.54	.37	20.80	.57
L 65-69	.131	.076	.0213	18.88	.51	26.89	.73
LSD .05	.007	.005	.0020	1.72	.05	2.11	.06
80-0-0	.117	.062	.0158	13.36	.39	19.95	.58
80-0-80	.114	.068	.0174	15.48	.43	21.69	.60
160-0-0	.117	.061	.0156	13.62	.38	20.09	.56
160-0-80	.111	.062	.0147	13.61	.37	20.40	.55
LSD .05	NS	.005	.0020	1.72	.05	NS	NS
Soil I	.115	.061	.0146	13.29	.37	20.28	.56
Soil II	.118	.066	.0165	14.40	.41	20.72	.58
Soil III	.111	.063	.0165	14.36	.40	20.60	.57
LSD .05	.006	NS	.0018	NS	NS	NS	NS
			First Stubble Cane				
CP 52-68	.105	.084	.0211	19.60	.53	26.44	.71
L 60-25	.114	.084	.0208	21.06	.53	27.60	.69
L 62-96	.131	.076	.0204	17.33	.51	25.85	.75
L 65-69	.148	.095	.0259	26.30	.64	37.74	.92
LSD .05	.010	.008	.0024	2.49	.05	2.72	.06
120-0-0	.130	.084	.0222	19.81	.55	28.22	.79
120-0-80	.125	.089	.0247	22.32	.60	30.51	.82
240-0-0	.123	.084	.0204	20.63	.53	28.79	.74
240-0-80	.121	.083	.0209	21.52	.53	30.10	.73
LSD .05	NS	NS	.0024	2.49	.05	NS	.06
Soil I	.128	.077	.0186	19.33	.49	28.09	.71
Soil II	.124	.090	.0240	22.75	.59	30.98	.80
Soil III	.121	.087	.0236	21.14	.57	29.15	.79
LSD .05	NS	.007	.0022	2.16	.05	2.36	.05

Phosphorus. — In plant and stubble cane, the P contents of plant parts shown in Table 23 were significantly higher from L65-69 than from the other varieties.

When compared with other varieties, the combination of higher tops and trash yields from L65-69 plant and stubble cane and higher P contents of the tops and trash indicate a higher amount of P remaining in the field following harvest of L65-69, but the higher bagasse and juice yields and higher P contents of the bagasse and juice from L65-69 show that more P was also removed from the field in millable cane. Although a comparison of data from all varieties showed that more P in tops and trash from L65-69 remained in the field following harvest, the comparison showed a greater absolute difference in amounts removed from the field in millable cane. Therefore, the principal concern for P nutrition of L65-69 may be application of fertilizer P to the variety when grown on soils normally considered adequate in P status, or application of a higher rate than normal on soils considered to require fertilizer P.

The relatively high amount of P in juice from L65-69 plant and stubble cane when compared with the other varieties may contribute to better juice clarification in milling operations.

The relationships of fertilizer treatments and soil types to the amounts of P in the plant parts were either not significant or not considered important.

The P contents of millable cane in pounds per ton and in above-ground parts in pounds per ton of millable cane, particularly in stubble cane, were generally higher than P contents normally found from cane grown on Mississippi terrace soils (*16, 21*).

Potassium. — Among varieties in plant and stubble cane (Table 24), K contents of above-ground parts per ton of millable cane showed no consistent trend. As an example, L62-96 contained significantly more K than L60-25 in plant cane, while the other varieties contained intermediate amounts, but L62-96 contained significantly less K than L65-69 in stubble cane, while the other varieties contained intermediate amounts.

In plant and stubble cane the effect of fertilizer K on the K content of millable cane in pounds per ton and on above-ground parts in pounds per ton of millable cane was of the order: N1-0-80> N1-0-0 and N2-0-80>

Table 24. — Mean potassium contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Potassium content						
	Tops&tr.	Bagasse	Juice	Millable cane(MC)		Above-ground parts	
	- - - - - % - - - - - - -			Lb/A	Lb/T	Lb/A	Lb/T MC
			Plant Cane				
CP 52-68	1.21	.43	.151	105.7	3.10	170.3	5.01
L 60-25	1.21	.35	.120	88.4	2.51	151.1	4.29
L 62-96	1.38	.40	.134	104.2	2.86	186.0	5.12
L 65-69	1.28	.33	.137	101.9	2.74	183.9	4.84
LSD .05	.10	.05	.023	15.5	.41	20.4	.57
80-0-0	1.23	.33	.111	81.3	2.37	154.2	4.37
80-0-80	1.31	.43	.162	119.4	3.31	190.7	5.29
160-0-0	1.25	.34	.118	87.8	2.48	157.0	4.43
160-0-80	1.29	.40	.152	111.6	3.05	189.5	5.16
LSD .05	NS	.05	.023	15.5	.41	20.4	.57
Soil I	1.21	.34	.122	91.7	2.53	166.6	4.56
Soil II	1.31	.38	.134	98.8	2.81	169.9	4.81
Soil III	1.29	.40	.150	109.6	3.06	182.0	5.07
LSD .05	.09	.05	.020	13.4	.35	NS	NS
			First Stubble Cane				
CP 52-68	1.06	.41	.156	116.4	3.11	185.2	4.98
L 60-25	1.20	.34	.141	109.9	2.74	178.4	4.46
L 62-96	1.06	.29	.107	75.9	2.24	144.8	4.24
L 65-69	1.25	.36	.155	123.3	3.02	220.2	5.39
LSD .05	.14	.05	.025	19.4	.45	23.9	.57
120-0-0	1.15	.31	.116	86.0	2.38	158.7	4.41
120-0-80	1.15	.41	.172	125.5	3.35	201.4	5.38
240-0-0	1.13	.31	.118	93.3	2.41	167.8	4.37
240-0-80	1.15	.37	.153	120.7	2.96	200.8	4.92
LSD .05	NS	.05	.025	19.4	.45	23.9	.57
Soil I	1.17	.28	.115	90.2	2.26	169.7	4.26
Soil II	1.09	.36	.141	109.4	2.85	180.8	4.71
Soil III	1.17	.41	.163	119.5	3.23	196.0	5.33
LSD .05	NS	.05	.022	16.8	.39	20.7	.49

N2-0-0. Comparisons of fertilizer treatments N1-0-0 with N2-0-0 and N1-0-80 with N2-0-80 showed that fertilizer N had no significant effect on K content of the cane.

Although some differences were not statistically significant, the K contents of millable cane in pounds per acre and pounds per ton and in above-ground parts in pounds per acre and pounds per ton of millable cane were of the order: Soil III> Soil II> Soil I in plant and stubble cane.

Calcium. — In plant cane (Table 25), Ca content of above-ground parts per ton of millable cane was statistically of the order: L62-96 = L65-69 =

Table 25. — Mean calcium contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Calcium content						
	Tops&tr.	Bagasse	Juice	Millable cane(MC)		Above-ground parts	
	- - - - - %	- - - - - - -		Lb/A	Lb/T	Lb/A	Lb/T MC
			Plant Cane				
CP 52-68	.319	.034	.0107	7.87	.23	24.94	.73
L 60-25	.264	.033	.0101	7.82	.22	21.52	.61
L 62-96	.309	.036	.0116	9.21	.25	27.54	.76
L 65-69	.269	.037	.0153	11.36	.31	27.82	.75
LSD .05	.028	.004	.0013	1.01	.03	2.31	.06
80-0-0	.292	.034	.0116	8.53	.25	24.82	.72
80-0-80	.284	.034	.0116	8.92	.25	24.29	.68
160-0-0	.294	.036	.0124	9.35	.26	25.62	.72
160-0-80	.290	.036	.0120	9.47	.25	27.08	.73
LSD .05	NS	NS	NS	NS	NS	NS	NS
Soil I	.288	.037	.0122	9.43	.26	26.78	.75
Soil II	.290	.033	.0125	9.10	.25	24.61	.70
Soil III	.292	.035	.0110	8.66	.24	24.98	.70
LSD .05	NS	.003	.0012	NS	NS	2.00	.05
			First Stubble Cane				
CP 52-68	.350	.044	.0117	10.49	.28	33.30	.90
L 60-25	.295	.042	.0114	10.97	.27	27.99	.71
L 62-96	.396	.054	.0151	12.76	.37	38.63	1.12
L 65-69	.293	.049	.0160	14.69	.36	37.31	.91
LSD .05	.033	.006	.0015	1.33	.04	3.99	.11
120-0-0	.325	.045	.0125	10.90	.30	31.62	.88
120-0-80	.325	.044	.0132	11.54	.30	32.89	.88
240-0-0	.342	.051	.0142	13.19	.34	35.79	.95
240-0-80	.341	.048	.0142	13.27	.32	36.92	.91
LSD .05	NS	.006	.0015	1.33	.04	3.99	NS
Soil I	.344	.050	.0153	13.82	.35	36.99	.94
Soil II	.336	.048	.0133	12.37	.32	34.39	.90
Soil III	.320	.044	.0119	10.48	.29	31.54	.88
LSD .05	NS	.005	.0013	1.15	.03	3.46	NS

CP52-68 > L60-25 and in stubble cane was of the order: L62-96> L65-69 = CP52-68 > L60-25.

No important relationship was noted between Ca contents of plant parts and fertilizer treatments applied to plant and stubble cane, but there was a tendency for Ca contents of the plant parts to vary in the order: Soil I> Soil II> Soil III.

Magnesium. — In plant cane (Table 26), Mg content of above-ground parts per ton of millable cane was statistically of the order: L62-96 =

Table 26. — Mean magnesium contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Magnesium content						
	Tops&tr.	Bagasse	Juice	Millable cane(MC)		Above-ground parts	
	- - - - - % - - - - - - -			Lb/A	Lb/T	Lb/A	Lb/T MC
			Plant Cane				
CP 52-68	.130	.035	.0129	8.60	.25	15.56	.46
L 60-25	.156	.043	.0141	10.60	.30	18.55	.53
L 62-96	.132	.047	.0155	12.11	.33	19.91	.55
L 65-69	.121	.142	.0175	12.93	.35	20.38	.55
LSD .05	.008	.004	.0018	1.13	.03	1.59	.04
80-0-0	.136	.042	.0149	10.45	.30	18.02	.52
80-0-80	.129	.040	.0143	10.77	.30	17.75	.50
160-0-0	.140	.044	.0154	11.39	.32	18.89	.53
160-0-80	.134	.043	.0153	11.65	.31	19.74	.54
LSD .05	.008	.004	NS	1.13	NS	1.59	.04
Soil I	.137	.045	.0161	11.93	.33	20.19	.56
Soil II	.136	.041	.0150	10.69	.30	17.82	.50
Soil III	.131	.040	.0139	10.57	.29	17.79	.50
LSD .05	NS	.003	.0016	1.01	.03	1.38	.04
			First Stubble Cane				
CP 52-68	.149	.047	.0144	12.07	.32	21.81	.59
L 60-25	.168	.051	.0152	13.82	.35	23.54	.59
L 62-96	.169	.064	.0177	15.02	.43	26.13	.75
L 65-69	.138	.051	.0170	15.63	.38	26.27	.64
LSD .05	.013	.005	.0010	1.44	.04	2.63	.06
120-0-0	.151	.052	.0154	12.94	.36	22.51	.63
120-0-80	.143	.048	.0154	12.98	.34	22.33	.59
240-0-0	.173	.059	.0168	15.15	.40	26.50	.70
240-0-80	.157	.055	.0168	15.47	.38	26.41	.65
LSD .05	.013	.005	.0010	1.44	.04	2.63	.06
Soil I	.170	.059	.0178	16.28	.42	27.67	.71
Soil II	.156	.053	.0159	14.17	.37	24.35	.63
Soil III	.143	.047	.0144	11.95	.33	21.29	.59
LSD .05	.011	.005	.0009	1.25	.03	2.28	.06

Table 27. — Correlation coefficients (r)[1] among topsoil pH, macronutrients in topsoil, and macronutrient contents of above-ground (AG) parts[2]

	Total N3/	AG N	"Soil" S	Ext. S	AG S	Ext. P	AG P	Ext. K	AG K	Ext. Ca	AG Ca	Ext. Mg	AG Mg
							Plant Cane						
Topsoil pH	.568	-.140	.702	.652	-.323	.138	.235	.596	.184	.802	.056	.410	-.292
Total N3/		-.179	.659	.563	-.156	.255	.114	.433	.116	.614	-.209	.284	-.289
AG N			.002	-.074	.412	.002	.028	-.290	-.053	-.224	.448	-.448	.525
"Soil" S				.671	-.085	.083	.309	.468	.155	.606	-.009	.310	-.189
Ext. S					-.228	.185	.375	.430	.265	.650	.080	.214	-.127
AG S						.220	-.123	-.656	-.282	-.498	.345	-.677	.168
Ext. P							.311	-.214	-.197	-.050	.279	-.158	.099
AG P								.028	.227	.056	.371	-.030	.260
Ext. K									.512	.862	-.332	.865	-.454
AG K										.373	-.020	.331	-.356
Ext. Ca											-.246	.671	-.493
AG Ca												-.478	.528
Ext. Mg													-.445
							First Stubble Cane						
Topsoil pH	.568	-.389	.702	.652	-.197	.138	.522	.596	.442	.802	.042	.410	-.301
Total N3/		-.364	.659	.563	.108	.255	.206	.433	.331	.614	-.083	.284	-.283
AG N			-.225	-.407	.167	.177	-.299	-.508	-.443	-.548	.372	-.481	.724
"Soil" S				.671	-.056	.083	.569	.468	.386	.606	.032	.310	-.209
Ext. S					.010	.185	.546	.430	.503	.650	.004	.214	-.298
AG S						.214	-.101	-.222	-.035	-.123	.420	-.384	.324
Ext. P							.046	-.214	-.163	-.050	.216	-.158	.236
AG P								.326	.545	.394	.078	.209	-.156
Ext. K									.605	.862	-.208	.865	-.532
AG K										.618	-.273	.366	-.636
Ext. Ca											-.161	.671	-.520
AG Ca												-.318	.781
Ext. Mg													-.506

1/ Least significant r at 1% level = .369. Lease significant r at 5% level = .285.
2/ Above-ground parts in pounds or fractional part of a pound per ton of millable cane.
3/ Total N in topsoil.

L65-69 = L60-25 > CP52-68 and in stubble cane was of the order: L62-96> L65-69 = L60-25 = CP52-68.

In stubble cane Mg contents of millable cane was increased in pounds per acre and pounds per ton, and it was also increased in above-ground parts in pounds per acre and pounds per ton of millable cane due to the higher level of fertilizer N. A similar trend occurred in plant cane, but the differences were not generally supported statistically.

There was a tendency for Mg contents of plant parts to vary in the order: Soil I> Soil II> Soil III, but the trend was stronger in stubble cane.

Correlations Among Topsoil pH and Macronutrient Contents of Topsoil, Leaf Blades, and Above-Ground Parts

Correlation coefficients among topsoil pH and macronutrient contents of topsoil, leaf blades, and above-ground parts are contained in Tables 27 through 29. With the exceptions of correlations discussed below under topsoil pH and macronutrient headings and correlations among topsoil pH and macronutrients, which were discussed previously (Table 3), the other relationships were considered to show no trends which provide practical information related to macronutrition of sugarcane in Louisiana.

Topsoil pH. — In plant cane (Tables 27 and 28), topsoil pH was negatively correlated with above-ground and leaf-blade S and Mg to a significant or highly significant degree. The correlation coefficients between topsoil pH and above-ground and leaf-blade S were r = -0.323 and r = -0.380, respectively, and between topsoil pH and above-ground and leaf-blade Mg were r = -0.292 and r = -0.364, respectively.

In stubble cane (Table 27), relationships between topsoil pH and above-ground N, P, K, and Mg were significant or highly significant (r = -0.389, r = 0.522, r = 0.442 and r = -0.301, respectively). The correlations between topsoil pH and leaf-blade S and Mg (Table 28) were highly significant (r = -0.598 and r = -0.372, respectively).

Nitrogen. — There was a tendency for the total N content of topsoil to correlate negatively with above-ground (AG) N in cane in pounds per ton of millable cane and with leaf-blade N (Tables 27 and 28). In Table 27 it may be seen that the relationship between topsoil N and above-ground N was significant in stubble cane (r = -0.364). In Table 29, it may be noted that above-ground N and leaf-blade N were significantly correlated in stubble cane (r = 0.333).

Sulphur. — ''Soil'' S and extractable S were not significantly associated with above-ground S in plant or stubble cane (Table 27). ''Soil'' S and leaf-blade S in stubble cane (Table 28) were negatively related (r= -0.447). It can be seen in Table 29 that correlations between leaf-blade S and above-ground S in plant and stubble cane were highly significant (r= 0.676 and r = 0.482, respectively).

Table 28. Correlation coefficients (r)[1] among topsoil pH, macronutrients in topsoil, and macronutrient contents of leaf blades (LB)

	Total N[2]	LB N	"Soil" S	Ext. S	LB S	Ext. P	LB P	Ext. K	LB K	Ext. Ca	LB Ca	Ext. Mg	LB Mg
Plant Cane													
Topsoil pH	.568	-.077	.702	.652	-.380	.138	.112	.596	.160	.802	-.143	.410	-.364
Total N[2]		-.011	.659	.563	-.175	.255	-.001	.433	.109	.614	-.283	.284	-.260
LB N			.065	.004	.227	-.114	.189	-.129	.381	-.047	-.139	-.190	.254
"Soil" S				.671	-.223	.083	.189	.468	.107	.606	-.100	.310	-.255
Ext. S					-.276	.185	.254	.430	.290	.650	-.074	.214	-.382
LB S						.221	.089	-.617	-.054	-.497	.435	-.713	.300
Ext. P							-.020	-.214	-.145	-.050	.208	-.158	.003
LB P								-.038	.540	-.047	.414	-.160	-.395
Ext. K									.324	.862	-.401	.865	-.478
LB K										.268	-.020	.061	-.394
Ext. Ca											-.349	.671	-.464
LB Ca												-.508	-.256
Ext. Mg													-.295
First Stubble Cane													
Topsoil pH	.568	-.218	.702	.652	-.598	.138	-.074	.596	.130	.802	-.059	.410	-.372
Total N[2]		-.151	.659	.563	-.407	.255	-.147	.433	.021	.614	-.005	.284	-.202
LB N			-.134	-.119	.461	-.105	.516	-.290	.443	-.283	-.089	-.336	.062
"Soil" S				.671	-.447	.083	.027	.468	.179	.606	-.028	.310	-.382
Ext. S					-.244	.185	.157	.430	.128	.650	-.085	.214	-.422
LB S						.007	.182	-.594	.081	-.557	.326	-.583	.191
Ext. P							.130	-.214	-.196	-.050	.283	-.158	.134
LB P								-.200	.407	-.234	.044	-.257	-.265
Ext. K									.310	.862	-.272	.865	-.457
LB K										.159	-.239	.119	-.377
Ext. Ca											-.180	.671	-.413
LB Ca												-.321	-.182
Ext. Mg													-.245

1/ Least significant r at 1% level = .369. Least significant r at 5% level = .285.
2/ Total N in topsoil.

Table 29. — Correlation coefficients (r)[1] among macronutrients in above-ground (AG) parts[2] and leaf blades (LB)

	LB N	AG S	LB S	AG P	LB P	AG K	LB K	AG Ca	LB Ca	AG Mg	LB Mg
					Plant Cane						
AG N	.217	.412	.323	.028	.046	-.053	.150	.448	.078	.525	.169
LB N		-.063	.227	-.109	.189	-.059	.381	-.232	-.139	.235	.254
AG S			.676	-.123	-.250	-.282	-.454	.345	.342	.168	.382
LB S				-.070	.089	-.293	-.054	.333	.435	.374	.300
AG P					.613	.227	.265	.371	.218	.260	-.159
LB P						.219	.540	.450	.414	.423	-.395
AG K							.479	-.020	.080	-.356	-.548
LB K								.001	-.020	.102	-.394
AG Ca									.621	.528	-.214
LB Ca										.144	-.256
AG Mg											.366
					First Stubble Cane						
AG N	.333	.167	.344	-.299	.241	-.443	.024	.372	.230	.724	.226
LB N		.052	.461	.001	.516	-.273	.443	.286	-.089	.533	.062
AG S			.482	-.101	.128	-.035	-.057	.420	.399	.324	-.041
LB S				-.401	.182	-.414	.081	.303	.326	.494	.191
AG P					.446	.545	.216	.078	-.276	-.156	-.320
LB P						-.074	.407	.508	.044	.505	-.265
AG K							.268	-.273	-.244	-.636	-.402
LB K								.121	-.239	.109	-.377
AG Ca									.548	.781	-.398
LB Ca										.361	-.182
AG Mg											.053

1/ Least significant r at 1% level = .369. Least significant r at 5% level = .285.

2/ Above-ground parts in pounds or fractional part of a pound per ton of millable cane.

Phosphorus. — The correlation between extractable P and above-ground P in plant cane, r = 0.311, was significant, but it was not significant in stubble cane (Table 27). Extractable P and leaf-blade P were not correlated significantly in plant or stubble cane (Table 28), but correlations between leaf-blade P and above-ground P in plant and stubble cane (r= 0.613 and r = 0.446, respectively) were highly significant (Table 29).

Potassium. — Correlations among extractable K, leaf-blade K, and above-ground K in plant and stubble cane were positive and were generally statistically significant or highly significant (Tables 27 through 29).

Calcium. — In plant cane, the negative relationship between extractable Ca and above-ground Ca (r= -0.246) approached significance (Table 27), and the negative relationship between extractable Ca and leaf-blade Ca (r = -0.349) was significant (Table 28). Although negative, similar relationships were not significant in stubble cane. The correlations between leaf-blade Ca and above-ground Ca in plant and stubble cane (r= 0.621 and r = 0.548, respectively) were highly significant (Table 29).

Magnesium. — In plant and stubble cane, the negative associations between extractable Mg and above-ground Mg (r = -0.445 and r =-0.506, respectively) were highly significant (Table 27). The negative association between extractable Mg and leaf-blade Mg (r = -0.295) was significant in

Table 30. — Mean micronutrient contents of plant and first stubble cane leaf blades as related to variety, fertilizer treatment, and soil type

Variable	Micronutrient content							
	Plant cane				First stubble cane			
	Fe	Mn	Zn	Cu	Fe	Mn	Zn	Cu
	ppm							
CP 52-69	46	26	16	6	57	58	23	5
L 60-25	50	29	19	5	62	48	27	5
L 62-96	53	32	22	8	61	66	34	6
L 65-69	50	31	12	6	71	61	25	5
LSD .05	NS	NS	5	NS	NS	10	NS	1
N1-0-0[1/]	52	25	18	7	62	57	26	5
N1-0-80	53	30	17	6	61	45	22	5
N2-0-0	50	30	16	6	61	70	27	5
N2-0-80	46	32	17	6	67	63	34	5
LSD .05	NS	NS	NS	NS	NS	10	NS	NS
Soil I	51	31	22	7	54	64	23	5
Soil II	48	24	15	6	61	56	27	5
Soil III	51	33	14	6	73	55	32	5
LSD .05	NS	8	5	NS	11	NS	NS	NS

1/ N1 = 80 lb of N/A for plant and 120 lb/A for first stubble cane.
N2 = 160 lb of N/A for plant and 240 lb/A for first stubble cane.

plant cane and approached significance (r = -0.245) in stubble cane (Table 28). Leaf-blade Mg and above-ground Mg were significantly correlated in plant cane (r = 0.366) but were not significantly correlated in stubble cane (Table 29).

Micronutrient Contents of Leaf Blades

Data in Table 30 show no general relationships among varieties, fertilizer treatments, and soil types, and the Fe, Mn, Zn, and Cu contents of leaf blades. There is no obvious explanation for the generally higher levels

Table 31. — Mean iron contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Iron content						
	Tops&tr.	Bagasse	Juice	Millable cane (MC)		Above-ground parts	
	- - - - -	ppm - - - - -		Lb/A	Lb/T	Lb/A	Lb/T MC
			Plant Cane				
CP 52-68	63	34	21	1.20	.035	1.54	.045
L 60-25	66	36	20	1.24	.035	1.59	.045
L 62-96	61	42	19	1.29	.036	1.66	.046
L 65-69	55	35	22	1.39	.038	1.73	.047
LSD .05	NS	NS	NS	NS	NS	NS	NS
80-0-0	65	34	19	1.15	.033	1.50	.044
80-0-80	60	35	21	1.28	.036	1.61	.045
160-0-0	60	38	20	1.25	.035	1.58	.045
160-0-80	61	41	23	1.46	.040	1.83	.050
LSD .05	NS	NS	NS	NS	NS	NS	NS
Soil I	78	39	24	1.44	.040	1.90	.053
Soil II	56	41	22	1.38	.039	1.68	.047
Soil III	50	32	16	1.04	.029	1.32	.037
LSD .05	12	NS	NS	NS	NS	.36	.011
			First Stubble Cane				
CP 52-68	107	80	15	1.64	.044	2.34	.064
L 60-25	105	64	18	1.69	.043	2.31	.058
L 62-96	106	88	19	1.86	.054	2.54	.074
L 65-69	98	71	21	1.97	.048	2.71	.067
LSD .05	NS	NS	NS	NS	NS	NS	NS
120-0-0	100	87	21	2.00	.056	2.64	.074
120-0-80	106	74	18	1.72	.047	2.40	.065
240-0-0	113	79	16	1.77	.047	2.51	.066
240-0-80	97	64	17	1.67	.040	2.34	.057
LSD .05	NS	NS	NS	NS	NS	NS	NS
Soil I	68	69	16	1.68	.043	2.15	.055
Soil II	127	84	21	2.07	.054	2.88	.075
Soil III	116	75	17	1.63	.046	2.41	.067
LSD .05	20	NS	NS	NS	NS	.45	.014

of Fe, Mn, and Zn in leaf blades from stubble cane compared with plant cane.

It may be noted from the leaf blade data and critical contents reported by Evans and Juang, Page 8, that Zn and Cu in plant cane and Cu in stubble cane may have approached critically low levels in the experiments. However, tests with Zn and Cu in Louisiana have failed to show any significant effect on cane and sugar yields or on micronutrient contents of leaf blades (*13*).

Table 32. — Mean manganese contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Manganese content						
	Tops&tr.	Bagasse	Juice	Millable cane(MC)		Above-ground parts	
	- - - - -	ppm	- - - - -	Lb/A	Lb/T	Lb/A	Lb/T MC
			Plant Cane				
CP 52-68	51	9	1.0	.14	.0041	.40	.0121
L 60-25	49	9	.9	.14	.0038	.39	.0110
L 62-96	55	13	1.6	.22	.0060	.55	.0150
L 65-69	65	16	2.0	.29	.0078	.68	.0184
LSD .05	9	3	.3	.04	.0011	.09	.0024
80-0-0	61	12	1.4	.20	.0057	.54	.0157
80-0-80	55	11	1.4	.20	.0054	.50	.0136
160-0-0	56	12	1.4	.20	.0055	.51	.0143
160-0-80	47	11	1.3	.19	.0051	.48	.0128
LSD .05	9	NS	NS	NS	NS	NS	.0024
Soil I	52	12	1.3	.19	.0055	.51	.0143
Soil II	52	11	1.3	.18	.0051	.46	.0129
Soil III	60	12	1.5	.21	.0057	.54	.0151
LSD .05	8	NS	NS	NS	NS	NS	NS
			First Stubble Cane				
CP 52-68	56	10	1.1	.18	.0048	.55	.0147
L 60-25	50	10	1.1	.20	.0051	.49	.0122
L 62-96	74	17	1.8	.29	.0086	.77	.0227
L 65-69	76	19	2.2	.39	.0096	.98	.0239
LSD .05	12	5	.6	.09	.0022	.15	.0040
120-0-0	67	13	1.5	.24	.0067	.68	.0192
120-0-80	62	14	1.7	.26	.0072	.67	.0184
240-0-0	63	16	1.6	.31	.0078	.73	.0187
240-0-80	64	13	1.4	.25	.0063	.70	.0173
LSD .05	NS	NS	NS	NS	NS	NS	NS
Soil I	61	14	1.6	.28	.0071	.70	.0175
Soil II	57	13	1.4	.24	.0063	.62	.0165
Soil III	74	15	1.7	.27	.0076	.76	.0211
LSD .05	11	NS	NS	NS	NS	NS	.0034

Micronutrient Contents of Above-Ground Parts

Calculations were made with data showing micronutrient contents of tops and trash, bagasse, and juice from Tables 31 through 34 and appropriate yields of tops and trash, bagasse, and juice shown in Table 19. The values obtained for micronutrient contents of millable cane in pounds per acre and pounds per ton and above-ground parts in pounds per acre and pounds per ton of millable cane are shown in Table 31 through 34.

Table 33. — Mean zinc contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Zinc content						
	Tops&tr.	Bagasse	Juice	Millable cane(MC)		Above-ground parts	
	- - - - -	ppm	- - - - -	Lb/A	Lb/T	Lb/A	Lb/T MC
			Plant Cane				
CP 52-68	33	11	1.4	.17	.0051	.34	.0102
L 60-25	30	13	2.8	.26	.0074	.42	.0120
L 62-96	24	16	1.9	.28	.0075	.42	.0115
L 65-69	21	14	2.4	.28	.0076	.40	.0109
LSD .05	10	NS	.8	.07	.0017	NS	NS
80-0-0	28	14	2.3	.25	.0073	.40	.0117
80-0-80	31	14	1.9	.25	.0069	.42	.0116
160-0-0	24	13	2.0	.23	.0065	.37	.0104
160-0-80	25	13	2.4	.26	.0069	.41	.0110
LSD .05	NS	NS	NS	NS	NS	NS	NS
Soil I	35	15	2.0	.25	.0070	.46	.0129
Soil II	26	12	2.1	.22	.0063	.36	.0102
Soil III	19	14	2.3	.27	.0074	.37	.0104
LSD .05	8	NS	NS	NS	NS	.09	.0023
			First Stubble Cane				
CP 52-68	35	9	1.7	.18	.0049	.41	.0109
L 60-25	34	12	2.3	.27	.0068	.47	.0116
L 62-96	32	12	2.5	.25	.0070	.46	.0134
L 65-69	24	16	3.1	.38	.0093	.57	.0138
LSD .05	NS	5	.9	.09	.0021	.12	NS
120-0-0	31	11	2.4	.25	.0068	.44	.0122
120-0-80	29	12	2.5	.28	.0072	.46	.0122
240-0-0	33	13	2.3	.30	.0075	.52	.0132
240-0-80	32	11	2.3	.27	.0064	.49	.0122
LSD .05	NS	NS	NS	NS	NS	NS	NS
Soil I	27	14	2.8	.33	.0081	.51	.0128
Soil II	39	10	2.4	.25	.0065	.50	.0130
Soil III	28	12	2.0	.24	.0064	.42	.0115
LSD .05	8	NS	NS	.08	NS	NS	NS

Iron. — Data in Table 31 indicate that significant differences in Fe content of plant and stubble cane were not obtained among varieties and fertilizer treatments.

Although in plant cane Fe contents of plant parts were generally of the order: Soil > Soil II= Soil III, the tendency in stubble cane was of the order: Soil II > Soil III> Soil I.

Manganese. — In plant cane (Table 32), the Mn content of above-ground parts in pounds per ton of millable cane was statistically of the

Table 34. — Mean copper contents of above-ground parts as related to variety, fertilizer treatment, and soil type

Variable	Copper content						
	Tops&tr.	Bagasse	Juice	Millable cane(MC)		Above-ground parts	
	- - - - -	ppm	- - - - -	Lb/A	Lb/T	Lb/T	Lb/T MC
			Plant Cane				
CP 52-68	2.7	1.2	.8	.042	.0013	.057	.0017
L 60-25	2.7	1.0	.6	.035	.0010	.049	.0014
L 62-96	3.6	1.2	.7	.046	.0013	.068	.0019
L 65-69	3.1	1.3	.6	.042	.0011	.061	.0017
LSD .05	.6	NS	.2	.006	.0002	.009	.0003
80-0-0	3.1	1.3	.7	.042	.0013	.060	.0017
80-0-80	2.9	1.2	.6	.041	.0011	.057	.0016
160-0-0	3.0	1.2	.7	.041	.0012	.057	.0016
160-0-80	3.1	1.1	.7	.042	.0011	.061	.0017
LSD .05	NS	NS	NS	NS	.0002	NS	NS
Soil I	2.5	1.6	.7	.048	.0013	.063	.0018
Soil II	3.3	1.2	.6	.039	.0012	.057	.0016
Soil III	3.2	.8	.7	.037	.0010	.056	.0016
LSD .05	.5	.3	NS	.006	.0002	NS	NS
			First Stubble Cane				
CP 52-68	3.2	2.0	.6	.050	.0013	.071	.0019
L 60-25	2.8	1.5	.5	.042	.0010	.058	.0014
L 62-96	2.9	2.0	.7	.052	.0015	.071	.0020
L 65-69	3.0	1.4	.5	.045	.0011	.068	.0016
LSD .05	NS	NS	.2	NS	.0003	NS	.0004
120-0-0	3.0	1.8	.6	.047	.0013	.067	.0018
120-0-80	2.7	1.5	.5	.042	.0011	.059	.0016
240-0-0	3.3	1.8	.5	.049	.0013	.071	.0019
240-0-80	2.9	1.7	.6	.050	.0012	.070	.0017
LSD .05	NS	NS	NS	NS	NS	NS	NS
Soil I	3.3	1.6	.6	.049	.0012	.072	.0018
Soil II	2.6	2.0	.6	.054	.0014	.071	.0018
Soil III	3.1	1.5	.5	.038	.0011	.058	.0016
LSD .05	.5	.5	NS	.010	.0003	.011	NS

order: L65-69 > L62-96 > CP52-68= L60-25, but in stubble cane was of the order: L65-69 = L62-96 > CP52-68 = L60-25.

Among fertilizer treatments and soil types, differences noted in Mn contents of plant parts did not appear important.

Zinc. — In plant cane (Table 33) the Zn content of millable cane in pounds per ton was statistically of the order: L65-69 = L62-96 = L60-25> CP52-68 and in stubble cane was of the order: L65-69> L62-96> CP52-68= L60-25. The Zn contents of above-ground parts in pounds per ton of millable cane did not differ significantly among varieties.

Zinc contents of plant and stubble cane generally were not related to fertilizer treatments or soil types.

Copper. — The Cu content of plant cane above-ground parts in pounds per ton of millable cane (Table 34) was of the order: L62-96 = CP52-68 = L65-69 > L60-25. A similar trend occurred in stubble cane.

Copper contents of plant and stubble cane were not related to fertilizer treatments.

Differences in Cu contents of plant and stubble cane related to soil types did not appear important.

Correlations Among Topsoil pH and Micronutrient Contents of Topsoil, Leaf Blades, and Above-Ground Parts

Correlation coefficients among topsoil pH and micronutrients in topsoil, leaf blades, and above-ground parts are contained in Table 35. Correlations among topsoil pH and micronutrients were discussed earlier from Table 5. With the exceptions of correlations discussed previously and those discussed below, the relationships appear to show no trends which may be of practical value when considering the micronutrition of sugarcane in Louisiana.

Topsoil pH. — Negative and highly significant correlations were found between topsoil pH and above-ground Zn and between topsoil pH and leaf-blade Zn of plant cane, but the relationships were not significant in stubble cane.

Iron, Manganese, Zinc, and Copper. — Extractable Fe was significantly correlated with above-ground Fe in plant cane (r=0.375), and highly significant negative correlations were noted between extractable Mn and above-ground Mn (r = -0.381) and between extractable Mn and leaf-blade Mn (r= -0.453). Leaf-blade Mn and above-ground Mn were highly correlated (r= 0.421).

In stubble cane the negative correlation between extractable Mn and above-ground Mn (r = -0.304) and positive correlation between leaf-blade Mn and above-ground Mn (r = 0.324) were significant.

No significant correlations were found among extractable Zn, above-ground Zn, and leaf-blade Zn, nor among extractable Cu, above-ground Cu, and leaf-blade Cu in plant or stubble cane.

Table 35. — Correlation coefficients (r)[1] among topsoil pH, micronutrients extractable from topsoil, and micronutrient contents of above-ground (AG) parts[2] and leaf blades (LB)

	Ext. Fe	AG Fe	LB Fe	Ext. Mn	AG Mn	LB Mn	Ext. Zn	AG Zn	LB Zn	Ext. Cu	AG Cu	LB Cu
						Plant Cane						
Topsoil pH	-.261	-.138	-.105	.457	.055	.034	.001	-.430	-.601	-.331	-.021	-.112
Ext. Fe		.375	.051	.038	-.358	-.203	.189	-.255	-.084	.291	-.066	.190
AG Fe			.083	-.057	-.107	-.005	-.021	.051	.024	.155	.090	.257
LB Fe				-.176	.033	.020	-.032	-.117	-.009	.057	-.084	.517
Ext. Mn					-.381	-.453	.151	-.429	-.360	.019	-.047	-.090
AG Mn						.421	.032	.339	-.064	.062	.363	.055
LB Mn							.135	.187	.133	.095	.256	.080
Ext. Zn								-.119	-.193	.840	-.018	-.134
AG Zn									.256	.103	.236	.088
LB Zn										.056	.221	.258
Ext. Cu											.124	.054
AG Cu												.273
						First Stubble Cane						
Topsoil pH	-.261	.312	.470	.457	.231	-.248	.001	-.080	.190	-.331	-.079	-.051
Ext. Fe		-.176	-.209	.038	-.183	.304	.189	-.336	-.204	.291	-.076	-.020
AG Fe			.101	.308	.414	-.041	.045	.190	-.044	-.015	.358	.163
LB Fe				.002	.309	.016	.081	-.034	.587	-.152	-.340	.004
Ext. Mn					-.304	-.104	.151	-.172	.092	.019	.034	.109
AG Mn						.324	.031	.462	.052	-.033	.203	.245
LB Mn							.104	.184	.257	.218	.327	.219
Ext. Zn								.053	-.085	.840	.090	-.016
AG Zn									.009	.117	.347	.151
LB Zn										-.127	-.091	.268
Ext. Cu											.245	.059
AG Cu												.069

1/ Least significant r at 1% level = .369. Least significant r at 5% level = .285.

2/ Above-ground parts in fractional part of a pound per ton of millable cane.

Summary and Conclusions

Field, laboratory, and statistical data were obtained in an investigation of the effect of N and K fertilizers and soil types on yield, yield components, and nutrient uptake of four sugarcane varieties. The varieties were CP52-68, L60-25, L62-96, and L65-69. Fertilizer treatments in pounds per acre of N, P_2O_5, and K_2O applied to plant cane were 80-0-0, 80-0-80, 160-0-0, and 160-0-80. Fertilizers applied to first stubble cane were 120-0-0, 120-0-80, 240-0-0, and 240-0-80. Fertilizer P was not applied to the test site due to the residual effect of P from filter press mud which was applied to the area approximately 20 years before the investigation began. The study was conducted on soils which varied from Baldwin silt loam (Soil I) to Baldwin silt loam-Iberia clay (Soil II) to Iberia clay (Soil III).

Yield and yield component data were collected at three harvest periods from plant cane in 1973 and at three harvest periods from first stubble cane in 1974. The harvest periods were in early October (Harvest 1), early November (Harvest 2), and late November (Harvest 3). Topsoil and subsoil samples were taken in the spring prior to fertilization of plant cane and were analyzed for macronutrient and selected micronutrient contents. Leaf-blade samples were taken in early July, and samples of total above-ground parts or production were taken in early November of each crop year.

Tops and trash, bagasse, and juice from the above-ground samples were analyzed for macronutrient and micronutrient contents and were reported separately and in combination. Nutrient contents of bagasse and juice were added and reported as elemental contents of millable cane in pounds per acre and pounds per ton, and nutrient contents of tops and trash, bagasse, and juice were added and reported as elemental contents of above-ground parts in pounds per acre and pounds per ton of millable cane.

In the summary and conclusions, comments concerning "above-ground" elements or elemental contents of "above-ground parts" refer to the total content expressed in pounds per ton of millable cane, and "leaf" generally equates to "leaf blade."

The small differences in mean nutrient contents of the plots on which varieties and fertilizer treatments were established apparently caused very little experimental bias.

As averages of variety and fertilizer treatments, macronutrient contents of soils were generally of the order: Soil III > Soil II > Soil I. Micronutrient contents of the three soils showed no consistent pattern.

From the plant cane crop, cane yield increases by each variety were approximately linear throughout the harvest periods. Sugar yield increases, however, were substantially larger from Harvest 1 to 2 than from Harvest 2 to 3. In stubble cane, yields of cane and sugar increased from Harvest 1 to 2, no increases occurred in cane yield from Harvest 2 to 3, and sugar yield increased from Harvest 2 to 3 only in CP52-68 and L62-96.

As averages of all controlled variables, sugar yields in plant cane from the varieties were of the statistical order: L65-69= L62-96> L60-25> CP52-68, whereas, the order in stubble cane was: L65-69 = L60-25 > L62-96> CP52-68.

In plant cane, yields of cane and sugar from the two levels of fertilizer N, as averages of all other variables, did not differ significantly, but application of fertilizer K resulted in highly significant increases in yields of cane, 1.39 tons per acre, and sugar, 382 pounds per acre. Sucrose content of normal juice from plant cane was not affected appreciably by the higher level of N, but with the addition of K was 0.28 percentage point higher in the early maturing varieties, L60-25, L62-96, and L65-69, and approached statistical significance.

As an average of the other variables, the higher level of N applied to stubble cane resulted in increases in cane and sugar yields from L65-69 and L62-96, but the increase in sugar yield from L62-96 only approached significance and was related to a significant variety x N interaction effect on sucrose. Sucrose content of normal juice from L62-96 was significantly lower (0.53 percentage point) due to higher N. Sucrose from CP52-68 was 0.39 percentage point lower, and from L65-69 was 0.28 percentage point higher due to the higher level of N, both of which approached significance. Cane and sugar yields and sucrose from L60-25 were not affected appreciably by higher levels of N, but in CP52-68 the higher level of N depressed the sugar yield significantly.

Application of fertilizer K to stubble cane was associated with highly significant increases in average yields of cane, 2.92 tons per acre, and sugar, 668 pounds per acre. The increase in yields of sugar, however, varied among varieties as was indicated by significant variety x K interaction effects on sugar yield and on sucrose content. Sugar yield increases due to K by L60-25 and L62-96 were highly significant, and the increase by L65-69 was significant, but the increase by CP52-68 was not significant. Sucrose from L62-96 increased significantly and from CP52-68 decreased significantly due to K. The average sucrose from the three harvests of the early maturing varieties increased 0.38 perrcentage point due to K, but the increases were of the order: Harvest 1> Harvest 2> Harvest 3. Additional work with early maturing varieties in eight tests during 1972-75 indicated corroborative results in that, in addition to net cane yield increases, sucrose increased substantially due to fertilizer K.

Cane yield averages from plant cane on Soils I and II were statistically equal but were higher than from Soil III. Sugar yield and sucrose averages from plant cane, however, were of the order: Soil III> Soil II> Soil I, but only the differences between Soils I and III were significant. Cane yield averages from stubble cane were statistically of the order: Soil I> Soil II= Soil III. Stubble cane sugar yield from Soil II was significantly higher than from Soil I and the yield from Soil III was intermediate. Sucrose contents from stubble cane were of the order: Soil III= Soil II> Soil I. Although sucrose from cane grown on Soil III was significantly higher than from Soil I in both plant and first stubble crops, results from sampling of second stubble on the test site in 1975 showed a significant reversal. These findings, coupled with mixed results in 1975 from work in two tests on soils near the Mississippi River, indicate a conclusion that no general trend appears to exist concerning sucrose content of cane grown on light- as opposed to heavy-textured soils in Louisiana.

Generally, mean stalk weights among varieties at all harvests of both plant and stubble cane were of the order: L62-96> L65-69 = CP52-68> L60-25, but they were not related to fertilizer treatments or soil types to an important degree.

In plant and stubble cane, stalk length among varieties at all harvests was of the order: L65-69 = CP52-68> L62-96> L60-25. There was a trend in plant cane for fertilizer K and stalk length to relate negatively, but the trend did not exist in stubble cane. There was also a trend in plant and stubble cane for stalk length to vary among soil types in the order: Soil I> Soil II> Soil III.

Stalk diameter was normally largest from L62-96 and smallest from CP52-68, but the differences were relatively small in stubble cane. Stalk diameter was not generally related to fertilizer treatments or soil types.

When considering all harvests, the number of millable stalks per acre was positively correlated with cane yield each crop year, but the correlation in stubble cane was higher. The number of millable stalks was negatively correlated with stalk weight in plant and stubble cane at all harvests.

Generally, plant cane yields from the three harvests were significantly correlated with corresponding stalk weights, lengths, and diameters. In stubble cane, six of the nine correlations were significant or highly significant.

In 11 of 12 determinations stalk weights from plant and stubble cane correlated to a significant or highly significant degree with corresponding stalk lengths and diameters.

From six measurements stalk length and diameter were negatively correlated at Harvest 2 of plant cane, and negative correlations between stalk length and diameter at Harvests 1 and 3 of stubble cane approached significance.

Juice extraction from plant and stubble cane was not significantly related to varieties, fertilizer treatments, or soil types.

Substantial lodging occurred in plant and stubble cane from all varieties except CP52-68, but degree of lodging was not significantly associated with fertilizer treatments or soil types.

Although N content of leaf blades from CP52-68 was lower in plant and stubble cane than from other varieties, the N content of above-ground parts did not vary significantly among varieties. The positive effect of higher rates of N applied to plant and stubble cane on leaf N contents was small but was consistent and substantially larger in above-ground parts. The tendency for total N content of topsoil to correlate negatively with leaf and above-ground N was attributed to the relatively poor aeration and the associated lower rate of organic matter oxidation and root activity in the heavier soils where total N content of soils was highest. The association between leaf N and above-ground N was positive in plant ($r = 0.217$) and stubble cane ($r = 0.333$) but was significant only in stubble cane.

Leaf and above-ground S contents did not differ appreciably among varieties and fertilizer treatments. Leaf S in plant and stubble cane and above-ground S in plant cane were statistically of the order: Soil I > Soil II=Soil III, whereas, ''Soil'' and extractable S in topsoil were of the order: Soil I < Soil II = Soil III. Correlations between leaf S and above-ground S in plant ($r = 0.676$) and stubble cane ($r= 0.482$) were highly significant. Plant parts in stubble cane generally were substantially lower in S content than plant parts in plant cane, which indicated some depletion of ''Soil'' and/or extractable (available) S due to removal of S by the plant cane crop.

The P contents of leaf blades and above-ground parts from L65-69 were substantially higher than from other varieties but did not differ appreciably among fertilizer treatments or soil types. Extractable soil P and leaf P were not correlated significantly in plant or stubble cane. Correlation between extractable P and above-ground P was significant only in plant cane ($r = 0.311$). Correlations between leaf P and above-ground P were highly significant in plant and stubble cane ($r = 0.613$ and $r = 0.446$, respectively). It was concluded that the high amount of P in juice from L65-69 may contribute to better juice clarification in milling operations. Due to a relatively high amount of P removed in millable cane and trash from L65-69, it was also concluded that application of fertilizer P may be required when the variety is grown on soils normally considered adequate in P status or application of a higher rate than normal on soils considered to require fertilizer P.

Although the K content of leaf blades from CP52-68 was relatively low in plant and stubble cane, K contents of above-ground parts showed no consistent trend among varieties. Fertilizer K had a positive and generally significant effect, and fertilizer N had no significant effect on K contents of leaf blades and above-ground parts from plant and stubble cane. Among soils the K content of above-ground parts was of the order: Soil III> Soil II> Soil I. Correlations among extractable soil K, leaf blade K, and above-ground K was positive and generally significant or highly significant.

Differences among varieties and fertilizer treatments in Ca and Mg contents of leaf blades and above-ground parts from plant and stubble cane apparently were not important since all of the contents were considered high when compared to critical levels. The Ca and Mg contents of soils generally were of the order: Soil III> Soil II> Soil I, whereas Ca and Mg contents of leaf blades and above-ground parts from plant and stubble cane were generally in the reverse order. Correlations between extractable soil Ca and leaf and above-ground Ca were negative but were not supported statistically as strongly as negative correlations between extractable soil Mg and leaf and above-ground Mg. Correlations between leaf Ca and above-ground Ca were highly significant in plant and stubble cane ($r = 0.621$ and $r = 0.548$, respectively). Correlation between leaf Mg and above-ground Mg was significant only in plant cane ($r = 0.366$).

No important relationships were noted among varieties, fertilizer treatments, and soil types, and the Fe, Mn, Zn, and Cu contents of leaf blades from plant and stubble cane. Generally, the Fe and Mn contents of leaf blades were substantially higher, and Zn and Cu contents were equal to or higher, than critically low levels reported by other workers.

Although some differences were found in above-ground micronutrient contents among varieties, fertilizer treatments, and soil types, the differences were not considered important since no yield responses to micronutrients have been observed in Louisiana (*8, 9, 13, 32*).

As an average of all controlled variables in the experiments, the Fe, Mn, Zn, and Cu contents of millable cane in pounds per ton were 0.036, 0.0055, 0.0069, and 0.0012, respectively. In Florida (*1*), the Fe, Mn, Zn, and Cu contents of millable cane and trash, which varied from about 3 to 18 percent, were 0.021, 0.0050, 0.0051, and 0.0016 pounds per ton, respectively. The Florida micronutrient data were obtained only from the last of 11 crops of cane on the same experimental site. Yield data were obtained from all of the 11 crops, each of which had received treatments with Fe, Mn, Zn, and Cu in various combinations, but there were no significant differences in tons of cane or sugar per acre due to treatments nor were deficiency symptoms observed.

Literature Cited

1. Andreis, H. J. 1975. Macro and micro nutrient content of millable Florida sugarcane. The Sugar Journal 1:10-12.
2. Association of Official Agricultural Chemists. 1960. Official Methods of Analysis. Washington, D. C. Ed. 9.
3. Bardsley, C. E., and J. D. Lancaster. 1960. Determination of reserve sulfur and soluble sulfate in soils. Soil Sci. Soc. Am. Proc. 24:265-268.
4. Baver, L. D. 1960. Plant and soil composition relationships as applied to cane fertilization. Hawaiian Planters' Record, 56:43.
5. Borden, R. J. 1946. The influence of certain mineral substances on the quality of sugarcane. Hawaiian Planters' Record, 50:59-64.
6. Bowen, J. E. 1975. Recognizing and satisfying the micronutrient requirements of sugarcane. Sugar y Azucar. Nov: 15-18.
7. Brupbacher, R. H., W. P. Bonner and J. E. Sedberry. 1968. Analytical methods and procedures used in the Soil Testing Laboratory. La. Agr. Exp. Sta. Bull. 632.
8. Davidson, L. G. 1954-61. Fertilizer investigations on sugarcane. Unpublished data, ARS, USDA, Houma, La.
9. De Ment, J. D., and M. B. Sturgis. 1949. Complete fertilizers for sugarcane. Report of Projects, Dept. of Agronomy, La. Agr. Exp. Sta.
10. Du Toit, J. L. 1959. Recent advances in nutrition of sugarcane in South Africa. Proc. ISSCT 10:432-441.
11. Evans, H. 1965. Tissue diagnostic analyses and their interpretation in sugarcane. Proc. ISSCT 12:156-180.
12. Golden, L. E. 1964-75. Fertilizer and soil fertility studies with sugarcane. Report of Projects, Dept. of Agronomy, La. Agr. Exp. Sta.
13. ————————. 1976. Micronutrient studies with sugarcane in Louisiana. Proc. ASSCT Vol. 6 (in press).
14. ————————. 1974. Nutrient availability and uptake by sugarcane. Report of Projects, Dept. of Agronomy, La. Agr. Exp. Sta.
15. ————————. 1971. Relationship between fertilizer and leaf blade P and S and sugarcane yield in Louisiana. Proc. ISSCT 14:695-701.
16. ————————. 1975. The effect of sugarcane production on nutrient contents of Mhoon and Jeanerette silt loams. La. Agr. Exp. Sta. Bull. 685.
17. ————————. 1971. The relationship of P, K, Ca and Mg extractable from soils to P, K, Ca and Mg contents of sugarcane leaf blades. Proc. ASSCT Vol. 1.
18. ————————. 1973. Yield and nutrient element content of roots and below-ground stubble as related to fertilization of sugarcane and soil variation. Proc. ASSCT Vol. 3.
19. ————————, and R. Ricaud. 1965. Foliar analysis of sugarcane in Louisiana. La. Agr. Exp. Sta. Bull. 588.
20. ————————————————. 1967. Sugarcane yield increases due to fertilizer in Louisiana. Sugar Bull. Vol. 45, No. 17.
21. ————————————————. 1963. The nitrogen, phosphorus and potassium contents of sugarcane in Louisiana. La. Agr. Exp. Sta. Bull. 574.

22. ——————————————. 1964. Uptake of nitrogen, phosphorus, potassium, calcium, magnesium and sulfur by sugarcane in Louisiana. Sugar Bull. Vol. 42, No. 14.

23. Henderson, M. T., B. L. Legendre, and D. P. Viator. 1969. Investigations in 1969 on genetics of economic characters in sugarcane. Report of Projects. Dept. of Agronomy, La. Agr. Exp. Sta.

24. Humbert, R. P. 1953. Basic problems of sugarcane nutrition. II. Applying basic facts in sugarcane fertilization. Proc. ISSCT 8:71-79.

25. Juang, T. C. 1975. Trace element nutrition of sugarcane. Taiwan Food and Fert. Tech. Ctr. Ext. Bull. 54.

26. Karim, H. 1975. The distribution of the micronutrient cations in the genetic horizons of soils in Louisiana. Ph.D. Dissertation, Louisiana State University Library, Baton Rouge.

27. Lakshmikantham, M. 1974. Application of phosphate and potash and their effect on the juice quality of cane crops following heavy nitrogen fertilization. Proc. ISSCT 15:633-636.

28. Mariotti, J. A. 1971. Associations among yield and quality components in sugarcane hybrid progenies. Proc. ISSCT 14:297-302.

29. Parish, D. H. 1962. Fertilizers and the sugar industry of Mauritius. Proc. ISSCT 11:77-83.

30. Patrick, W. H., Jr., R. Wyatt, and R. H. Brupbacher. 1964. A study of chemical and physical properties of three alluvial soils in the sugarcane area of Louisiana. La. Agr. Exp. Sta. Bull. 580.

31. ————————, F. T. Turner, and R. D. Delaune. 1969. Soil oxygen content and root development of sugarcane. La. Agr. Exp. Sta. Bull. 641.

32. Ricaud, R. 1964-75. Effects of fertilizers on yield of sugarcane. Report of Projects, Dept. of Agronomy, La. Agr. Exp. Sta.

33. ——————. 1965. Soil potassium and response of sugarcane to fertilizer potassium in Louisiana. La. Agr. Exp. Sta. Bull. 594.

34. ——————, and L. E. Golden. 1964. Calcium and magnesium uptake by sugarcane in Louisiana. Sugar Bull. Vol. 43, No. 6.

35. Samuels, G., and P. Landrau, Jr. 1956. The sucrose content of sugarcane as influenced by fertilizers. Proc. ISSCT 9:365-374.

36. Sedberry, J. E., Jr., F. J. Peterson, E. Wilson, A. L. Nugent, R. M. Engler, and R. H. Brupbacher. 1971. Effects of zinc and other elements on the yield of rice and nutrient content of rice plants. La. Agr. Exp. Sta. Bull. 653.

37. Sornay, A. D., and O. Davidson. 1959. Relationship between growth of cane and yield of cane at harvest. Proc. ISSCT 10:390-398.

38. Tabayoyong, F. T. 1959. The effects of soil type and fertilization on the yield of cane in the Philippines. Proc. ISSCT 10:398-407.

39. Tonimoto, T. and G. Burr. 1959. The growth of sugarcane as influenced by nitrogen fertilization. Proc. ISSCT 10:450-461.

40. Walkley, A., and I. A. Black. 1934. An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chronic acid titration method. Soil Sci. 37:29-38.

41. Wang, S. C. 1954. Taiwan sugarcane soils and fertilizers. Proc. ISSCT 8:117.